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ROCK INSCRIPTIONS IN BRAZIL.[1]

BY JOHN C. BRANNER.

IN 1876 I visited Aguas Bellas, a small town in the interior of the province of Pernambuco, and about a hundred miles from the coast, for the purpose of examining localities said to contain the remains of extinct mammals.

The fossils were found at and in the vicinity of a cattle ranch known as Lagôa da Lagea, eight leagues east of Aguas Bellas. During the time spent at this place I learned of several rocks in the vicinity bearing inscriptions which, it was said, no man could read. I took time to visit the most convenient of these localities and to make careful drawings of the markings, the characteristic ones of which are here represented (Plates XXXIV-VI).

The first place visited for this purpose was a small farm about a league from Lagôa da Lagea, known as Cacimba Circada. The rock found at this place, together with its inscription, is shown at *k* (Plate XXXIV). This rock is a gneiss boulder of decomposition, about 10′ × 6′ × 6′, lying upon the bed rock near the Rio Garanhunzinho. On the right, as one faces the inscription, is an asterisk a foot in diameter, made by four lines crossing each other at equal angles, while the remainder of the inscription on the left consists of three rows of marks or indentations that run down from near the top

[1] The present contribution is intended to supplement the work begun by my friend and teacher, the lamented Professor Ch. Fred. Hartt, who was deeply interested in the archæological and ethnological work yet to be done in Brazil. It was while working upon the Imperial Geological Commission of Brazil, and under his directions, that these observations were made.

The NATURALIST for May, 1871, contains an article by Professor Hartt upon Brazilian rock inscriptions.

of the rock about two and one-half feet to where a portion of the block has split off from the lower left corner, probably carrying away part of the inscription. It is impossible to determine the exact number of these points, for some of them, especially those next the top, have become very indistinct through the weathering of the face of the rock. The inscriptions appear to have been made by pecking with stone implements, and in the case of the asterisk the stone was rubbed up and down the line until the furrows were well polished. After being ground out these points and lines were painted, the color now having a dull red or brown appearance.

The next place visited was Pedra Pintada (painted stone) which is located upon a stream (during the rainy season) taking its name from the marked stones—Rio da Pedra Pintada.[1] It is said to be ten leagues from Aguas Bellas, twelve from Garanhuns and nine from Papacaça. There are here about forty designs engraved, and part of them both engraved and painted upon the large blocks of gneiss on the banks, and upon the flat smooth rock in the dry bed of the stream. There is a cascade about twenty-five feet high just here, and at the foot of it a pot-hole, now filled up, which is about fifteen feet wide by as many deep, and to the presence of which these inscriptions are possibly due, as I shall show. The forms of the inscriptions are shown in the figures, which are drawn to scale, and I need not describe them in detail. Figs. *a*, *b*, *c*, *d*, *e*, *f*, *r* and *s* are engraved on the bed rock of the stream above the cascade. These are not painted, and if they ever were, the paint has been washed off by the stream charged with sand and gravel. Many of these are becoming indistinct, some of them have almost entirely disappeared, while others have doubtless disappeared altogether. The concentric chipping of the rock, so common in the tropics, has also removed some of the inscriptions both in the bed of the stream and upon the banks.

The engraving appears to have been done like that at Cacimba Circada, by pecking and grinding with stones having thin rounded edges. After being thus polished these marks were painted, the color now showing as a dull red or brown. In some cases the points and lines are combined as is shown in *e* and *f*. The ar-

[1] Lower down this stream is called Riacho dos dois Riachos, and flows into the Ipanema at Sant' Anna, which enters the São Francisco about midway between Traipú and Pão d'Assucar.

rangement of points in parallel vertical lines is rather frequent, occurring several times here (Fig. *v*), as well as at Cacimba Circada (Fig. *k*), and at Sant' Anna (Fig. *x*). There are several such rings as that shown at *e*, one of them having thirty-four points instead of thirty-six, while others are broken, or the points are too indistinct to be determined. There are two asterisks of eight rays, one associated with other markings (Fig. *v*) and another one independent, while still another asterisk has twenty rays (Fig. *p*). The only figure that seems to be intended to represent anything is Fig. *r*, which appears to be a rude representation of a spear-head. Part of Fig. *o* might be supposed to represent a fish, but I fancy that whatever resemblance there may be is accidental. The resemblance between some of these designs and some given by Professor Hartt[1] from the Amazon region is noteworthy, especially that of the spiral shown in *h* and that of the circle with the point at the center, such as are shown at *j*.

Returning from Aguas Bellas to the Rio Sao Francisco by way of the village of Sant' Anna, in the province of Alagôas, at half a league from this latter place I found the figures shown at *x* inscribed upon the side of a large gneiss boulder of decomposition. These figures are both cut and painted, and have the same dull red color as those at Pedra Pintada. There are other marks upon the vertical faces of this and of the other boulders of the group, evidently made by the same hands. These are simply polished spots varying in size from one to two feet in diameter. They are, for the most part, nearly round, but some of them are oblong, and none of them are more than about a quarter of an inch in depth—most of them not so deep, and are all painted. The stones upon which these inscriptions are made, as has already been stated, are gneiss boulders of decomposition, about a dozen in number, from six to twelve feet in height, and are grouped together upon the summit of a little hill of solid gneiss, as shown in the accompanying sketch.

The boulders near Sant' Anna, Province of Alagôas.

[1] AMERICAN NATURALIST, May, 1871.

The inscription *x* is upon the largest and most prominent of these boulders, while many, though not all the others, have polished places upon their sides such as I have described. During dry weather there is no water in the immediate vicinity, though the Ipanema[1] is only about a mile distant.

Sant' Anna inscriptions.

It should be noted that these inscriptions, as well as many others which I heard of through this part of the country, are all upon these large stones, and generally in some such prominent place.[2] One inscription in particular was mentioned to me by several persons, all of whom gave substantially the same account of it. This inscribed rock is near Agua Branca, twelve leagues above Piranhas and ten leagues from the falls of Paulo Affonso, on the *Fazenda da Caisára*, and is known as the *pedra navio*, or ship stone. It is said to be a large and nearly round boulder, standing upon a very narrow base upon the solid rock, and to have all its sides covered with Indian inscriptions.[3]

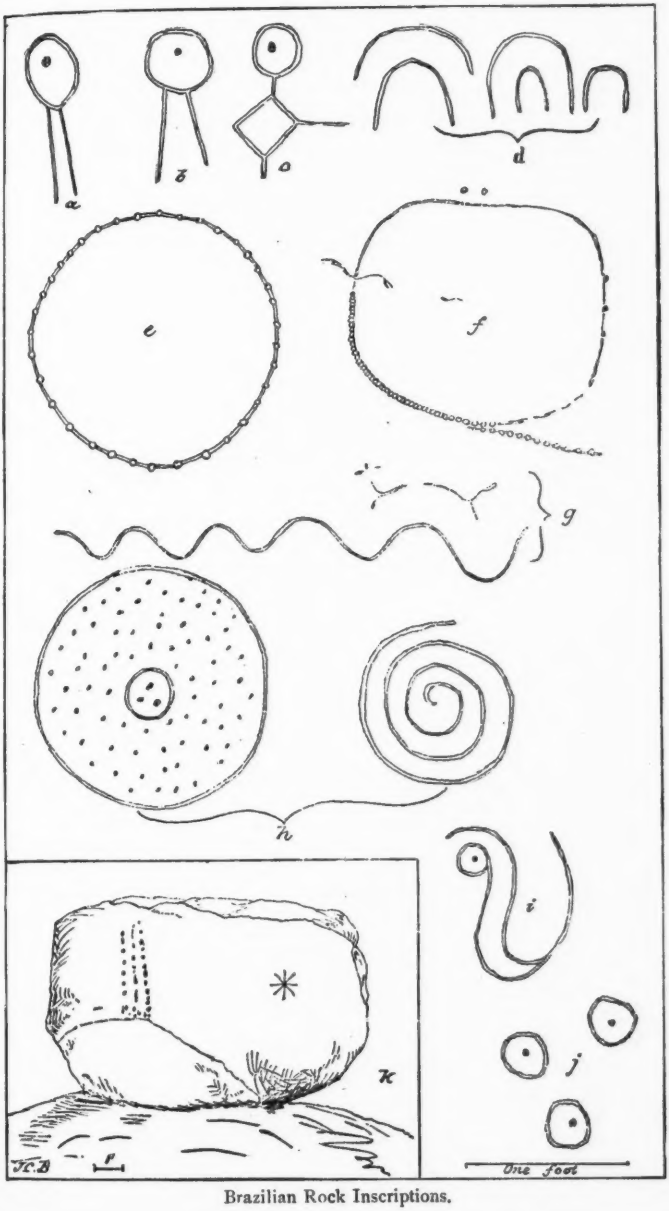
Through this part of the country, where the archæan rocks form a wide belt between the plateaus of the interior and the Cretaceous and Tertiary beds near the coast, these boulders of decomposition are not uncommon, and almost every one that I have seen has had some sort of artificial marks upon it, generally too badly eroded to be defined, but sufficiently distinct to leave no doubt concerning their origin.

Of the figures themselves I am unable to suggest any definite explanation. The explanations given by the people in the vicin-

[1] Not "Panema" as the geographies give it.

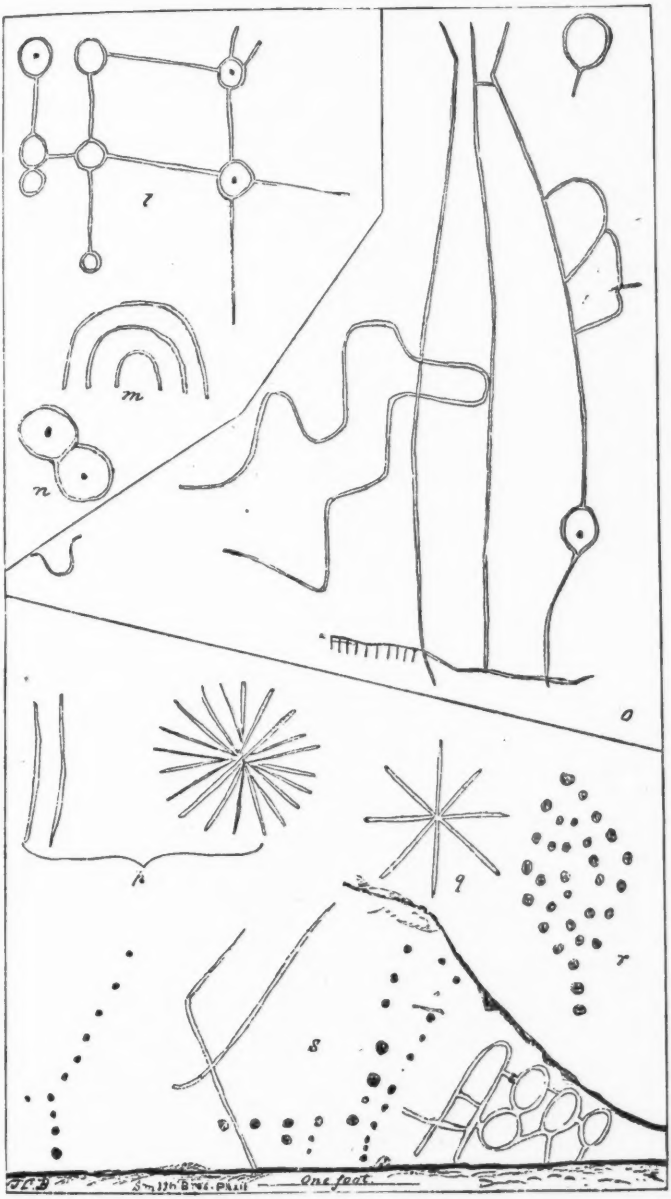
[2] The inscribed rocks at Ereré described by Professor Hartt are also prominent ones.

[3] I was told that there are extensive rock inscriptions further up the Rio São Francisco at Salgueiro on the Rio Quixába and at Ouricury, both in the western part of the province of Pernambuco. On the road between Diamantina and Beribery, in the province of Minas Geraes, are some rude Indian paintings of animals upon a ledge of rock. These latter I have seen, but had no opportunity of sketching them.



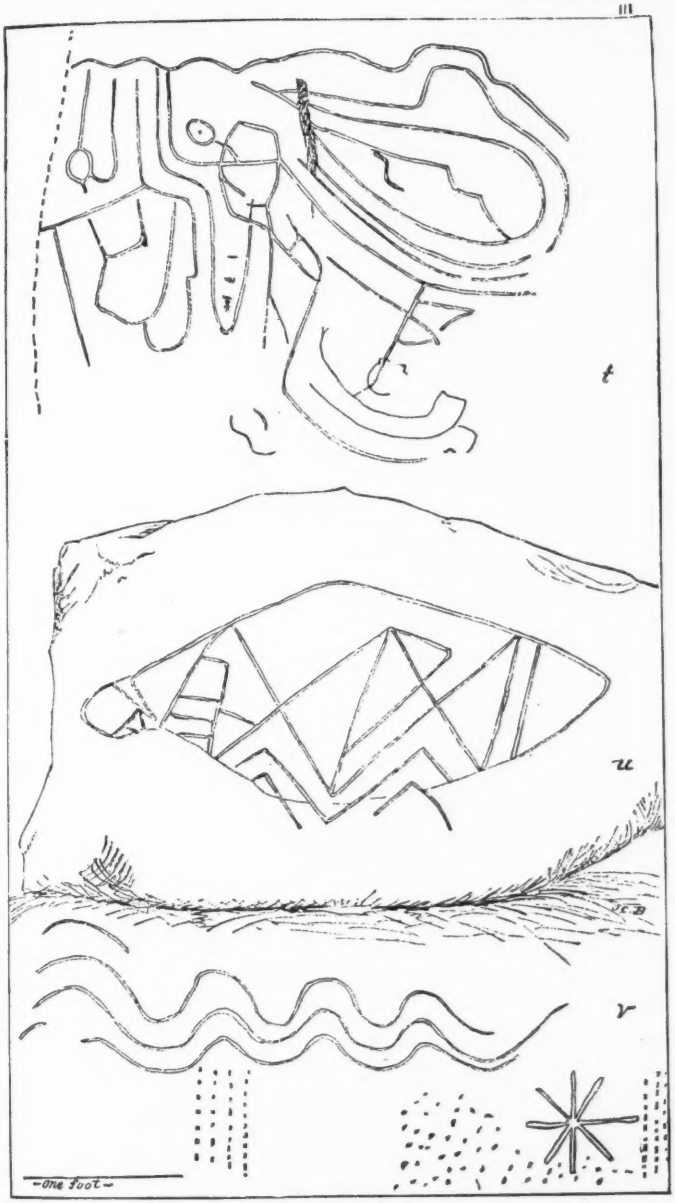
Brazilian Rock Inscriptions.

PLATE XXXV.



Brazilian Rock Inscriptions.

PLATE XXXVI.



Brazilian Rock Inscriptions.

ity throw no light upon the subject. Some think they were made by the Dutch when they held the country about Pernambuco in the early part of the seventeenth century, but the general impression is that they refer to some treasure hidden in the neighborhood. This idea led a former proprietor of the country about Pedra Pintada to make diligent search for this supposed treasure, and he even cleaned out the great pot-hole at the foot of the cascade, but without finding anything.

It is to be noted, however, as far as I have observed, that these inscriptions are always near the water, or near a place where water is likely to be found late in, if not quite through the dry season.[1] At Pedra Pintada the pot-hole below the fall has water in it long after the stream proper has dried up, the Ipanema has never been known to dry up entirely at Sant' Anna, while Cacimba Circada (fenced spring) takes its name from a spring at that place. This occurrence of the inscriptions in the neighborhood of water might admit of more than one explanation. If they have no other relation to the water itself, they happen to be in these localities because these are the places where the original inhabitants of the country would naturally live during the dry season, which is here nearly half the year, and indeed a part of these inscriptions at least—those in the bed of the stream—must have been made during the dry season. I am, however, inclined to the opinion that a part if not all these markings refer in some way to the water supply which is so uncertain in this region of great drouths. Exactly in what way, whether as records of seasons, or as petitions or offerings to the powers supposed to bring rain, it is idle now to speculate. To one visiting this section during the dry season, which lasts from August till January, there is no more natural explanation. The whole country is parched except the cacti and a very narrow strip bordering the now dry beds of the streams. Beyond these threads of gradually disappearing green one may travel for leagues and leagues without seeing a sign of water, and when, as not infrequently happens, the dry season is prolonged, the suffering of man and beast is extreme. The cattle subsist upon the pulp of the cacti that grow here

[1] There can be no confusing these markings with the holes made in large stones by Indians grinding their corn, and which also occur near the water. Many excellent examples of these mortar holes were found by me at the foot of the Pão d'Assucar, on the Rio São Francisco. They are made in the upper surface of large fragments of rock near the river.

abundantly, while the herdsmen obtain water for them by digging holes in the sand of the river beds wherever water may be found in this manner. If the drouth still continues beyond this stage, the cattle are driven toward the coast to where water may be had, or they are left to perish of thirst.[1]

Without experience of such circumstances it is, perhaps, not easy to realize the force of the argument, but after riding for days through this region with a tropical sun blazing overhead, the atmosphere so dry that it seems to parch one's very vitals, and the heat from the glaring white sand quivering upwards to a cloudless sky, the thin *catinga* forest shriveled and still, with not a sign of animal life save the metallic stridulation of an occasional grasshopper, and after passing now and then a whole day without water, one realizes the importance which savage races, dwelling in such a country, would attach to a stream or pool where water could be had during the dry season.

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THE AMBLYPODA.

BY E. D. COPE.

(Continued from page 1121, November number.)[2]

PANTODONTA.

THERE is known as yet but a single family of this suborder, the Coryphodontidæ. Its representatives have been found in the lower lacustrine Eocene beds in Europe and North America in considerable abundance. About twenty species have been described, of which three have been found in England and France, and the remainder in the Rocky Mountain region of North America. They form a curious and interesting group of hoofed Mammalia which did not survive the Lower Eocene time, except in their probable descendants, the Dinocerata. The characters of the suborder have already been given in the NATURALIST, page 1111.

Five genera of the Coryphodontidæ are known from dental characters. Two of these, Coryphodon and Bathmodon, are known in their skeletal structure, the first-named very thoroughly.

[1] The circumstances under which I found the remains of extinct mammals in this region lead me to believe that their extermination was caused by long drouths over great areas.

[2] The explanations of Fig. 7 (p. 1115) should read four-ninths nat. size; not two thirds nat. size.

Bathmodon is nearest to the genus Pantolambda in its foot structure. The astragalus has the same subquadrate outline (compare Figs. 3 *d* and 19 *a*), and possesses, as in that genus, a facet on its internal anterior angle, for another bone. This character is found among recent Mammalia in certain rodents, where a separate bone, the internal navicular, articulates with the internal extremity of the astragalus. This is probably the case in Bathmodon and Pantolambda, but the separate bone has not been found. In Coryphodon it is evidently wanting, as the astragalus terminates internally in a hook-like apex, which gives it a very peculiar appearance (Fig. 2). Until I traced this astragalus to Coryphodon in 1873,[1] the relation of this genus to the Dinocerata had not been suspected.

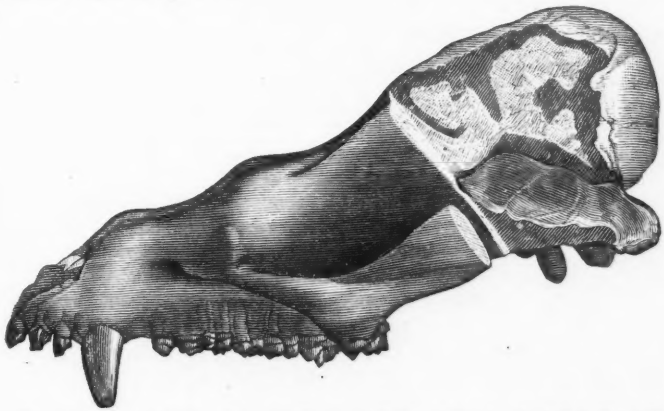

FIG. 12.—*Coryphodon elephantopus* Cope, skull from left side, the left half of the posterior part removed so as to display the small size of the brain cavity; two-ninths natural size. From Wasatch bed of New Mexico. Original.

The small size of the brain in this family is well displayed in the section of the skull of Coryphodon represented in Fig. 12, where the cavity it has occupied is exposed. Its relations to the skull are entirely different from those observed in all recent Mammalia excepting the elephants. As in them the diploë is represented by large air chambers.

The characters of the brain itself may be learned from Fig. 13. The exceedingly small size of the cerebral hemispheres at once arrests the attention, being much smaller than in the

[1] On the short-footed Ungulates of the Eocene of Wyoming. Proceedings Amer. Philosoph. Society.

cotemporary genus Phenacodus,[1] and agreeing with Uintatherium, which has been described by Marsh. There is no trace of sylvian fissure nor of convolutions. The middle brain is entirely exposed, and how much pertains to this and how much to the cerebellum remains uncertain. The anterior prolongation of the anterior pyramids is visible below the middle brain, as though the pons varolii were wanting (Fig. 13 *p*).

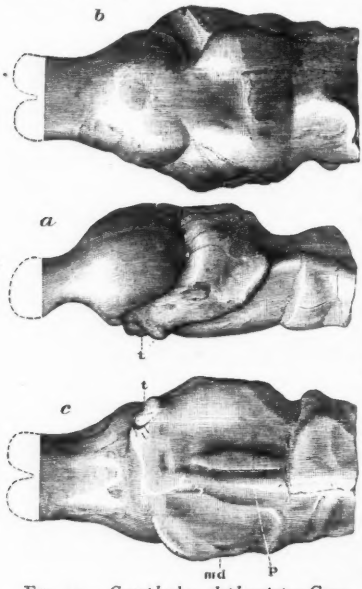

FIG. 13.—*Coryphodon elephantopus* Cope, cast of brain cavity seen in fig. 12, about one-third nat. size. Fig. *a*, left side; *b*, above; *c*, below. *t*, origin of trigeminus nerve; *p*, anterior pyramids. Original, from Proceed. Amer. Philos. Soc., 1877.

The characters of the long bones which are common to the members of this family may be observed in the *Bathmodon pachypus*, Figs. 14–15. The humerus shows the robust but not hooked tuberosities of the head, and the simple condyles. The radius shows the simple transverse head and the lateral distal facet. The femur (Fig. 15 *b*) has well developed trochanters, including the third, and a fossa ligamenti teris. The ilium (Fig. 15 *a*) like that of animals with a large belly, is much expanded, and has a wide peduncle. The pubis and ischium are light.

The five genera of Coryphodontidæ differ as follows:

I. Superior molars with two interior cusps.

All the superior molars with a well-marked external posterior V..... *Manteodon.*

II. Last superior molar with but one inner cusp or angle.

a. Last superior molar with posterior external cusp.

Anterior two molars with posterior external V..... *Ectacodon.*

aa. Last superior molar without external posterior cusp.

†Anterior two molars with posterior external V.

Astragalus transverse, with internal hook and no facet..... *Coryphodon.*

Astragalus subquadrate, with an internal facet and without internal hook, *Bathmodon.*

††First superior molar only, with posterior external V..... *Metalophodon.*

[1] See NATURALIST, 1884, p. 898, for figure.

The general relation of the teeth of these genera to those of other families of the order has been discussed (supra p. 1117). Their relation to each other may be understood by comparison of Fig. 9 *a* and *f* with Fig. 16. In the latter the anterior external V is marked a, and the posterior p. The posterior exterior angle of the latter is designated by the letter e. In Manteodon (Fig. 9 *f*) the posterior external V is observed to be well developed on the last superior molar. In Ectacodon (Fig. 16 *a*) its posterior edge is represented by an external cusp only (e), the rest of the border

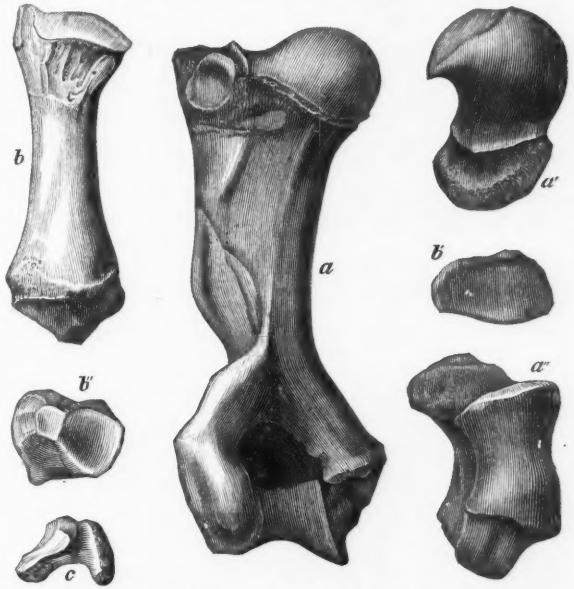

FIG. 14.—*Bathmodon pachypus* Cope, bones of fore limb, one-fifth nat. size, from Wasatch beds of Wyoming. Fig. *a*, left humerus from behind; *a'*, proximal, *a''*, distal views. Fig. *b*, left radius from behind; *b'*, proximal, *b''*, distal views; *c*, pisiform bone. From Vol. III Report U. S. Geol, Survey, F. V. Hayden.

being absent. In Coryphodon this border is sometimes traceable (*C. anax*, Fig. 9 *a*) or is wanting. In Metalophodon it is entirely absent, and is represented by a conical projection of the posterior crest only (Fig. 16 *b* p). The posterior V of the second superior molar is distinct in all except Metalophodon (Fig. 16 *b* p), where it is represented by a crest only, as in the last molar of most of the species of Coryphodon. The succession is thus seen to consist of the gradual conversion of the external Vs into

transverse crests, a process which is consummated in the Dinocerata of the later Bridger epoch (see Fig. 10).

Of Bathmodon two species are known, *B. radians* (Fig. 18) and *B. pachypus* (Figs. 14, 15 and 19). The latter is the larger,

FIG. 15.—*Bathmodon pachypus* Cope, bones of individual figured in Fig. 14, one-fifth nat. size. Fig. *a*, left innominatum, somewhat distorted, internal view; *b*, left femur from behind. Original, from Wasatch beds of Wyoming.

equaling a large ox in dimensions. The crania of these species are unfortunately unknown. Both are from the Wasatch beds of Wyoming.

Of Ectacodon Cope, but one species, the *E. cinctus*, has been

discovered. It is only known from the superior molar teeth fig-

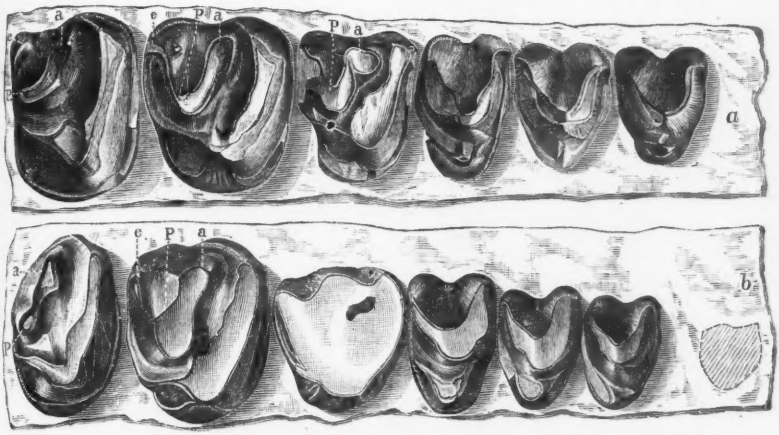

FIG. 16.—Superior molar series of Coryphodontidæ, two-thirds nat. size, from the Wasatch beds of Wyoming. Original. Fig. *a*, *Ectacodon cinctus* Cope. Fig. *b*. *Metalophodon testis* Cope.

ured in Fig. 16 *a*. It is a large species, about equal to the *Bathmodon radians*.

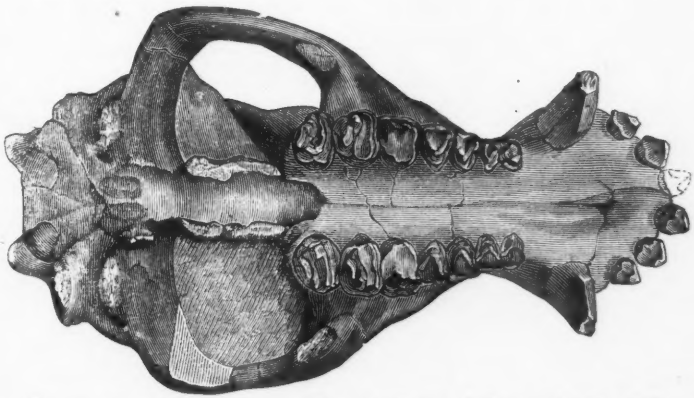

FIG. 17.—*Coryphodon elephantopus* Cope, skull, two-ninths nat. size, from below. Original, from Report G. M. Wheeler, U. S. G. G. Surv. W. of 100th mer., Vol. IV, pt. II.

The greater number of species of the family belong to Coryphodon. In this genus the temporal fossæ are lateral, as in modern ruminants, leaving a wide front with overhanging tem-

poral ridges (Figs. 20–21). The dental formula is the complete one of I. $\frac{3}{3}$; Pm. $\frac{4}{4}$; M. $\frac{3}{3}$. The superior canines are very powerful, and have three sides, giving a triangular section. In some of the species (*C. molestus*), this tooth is more compressed

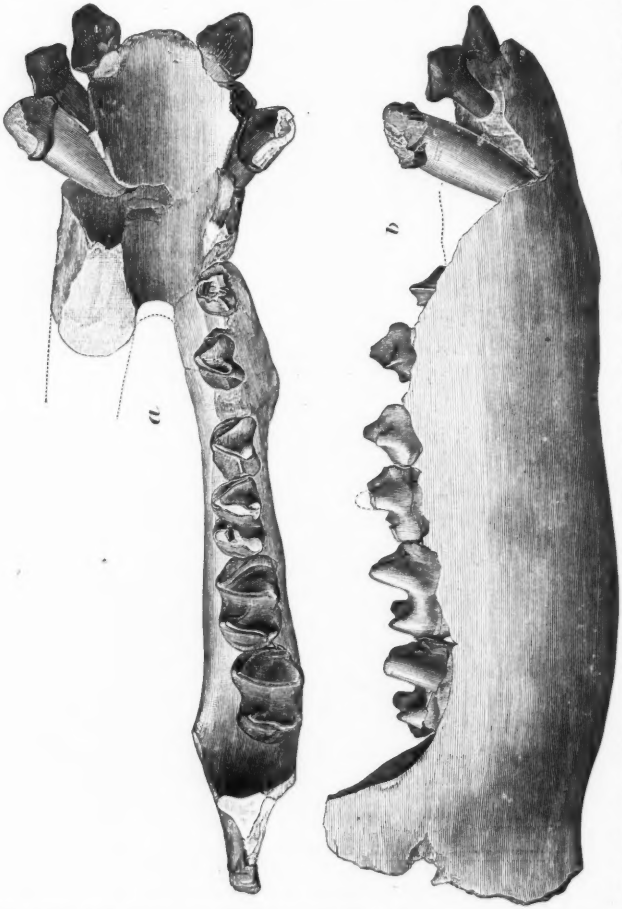

FIG. 18.—Lower jaw associated with the foot bones of *Bathmodon radians* Cope, from the Wasatch beds of Wyoming, three-eighths nat. size. From the small size of the canine probably a female. Original.

towards the apex, and the posterior face is narrow and concave, forming a groove. The inferior canines are also triangular in section, and the anterior angle is produced into an ala at the base (Figs. 9 *c*, 23 *i*). The neck and tail are of median length.

The general appearance of the Coryphodons, as determined by

the skeleton, probably resembled the bears more than any living animals, with the important exception that in their feet they were much like the elephants. To the general proportions of the bears must be added a tail of medium length. Whether they were covered with hair or not is, of course, uncertain; of their nearest living allies, the elephants, some were hairy and others naked. The top of the head was doubtless naked posteriorly, and in old animals may have been only covered by a thin epidermis, as in the crocodiles, thus presenting a rough, impenetrable front to antagonists.

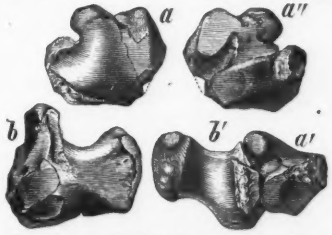

FIG. 19.— *Bathmodon pachypus* Cope, bones of foot of individual represented in figs. 14 and 15, one-fifth nat. size. Fig. *a*, astragalus from above; *a'*, inner side; *a''*, below. Figs. *b b'*, calcaneum.

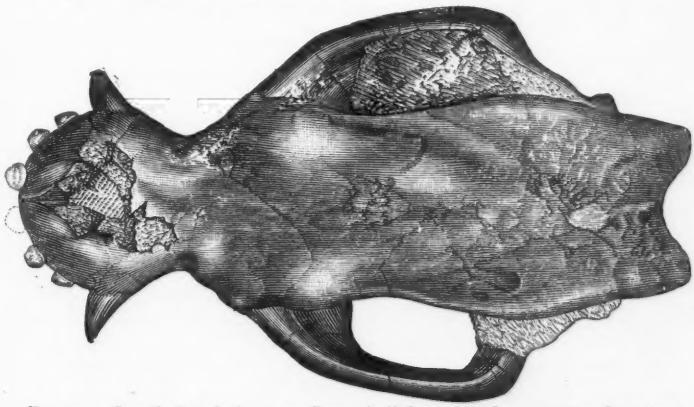

FIG. 20.—*Coryphodon elephantopus* Cope, skull figured in figs. 12, 17 and 21, two-ninths nat. size, from above. From Wasatch bed of New Mexico. Original, from Report U. S. G. G. Surveys and G. M. Wheeler, Vol. IV, pt. II.

The movements of the Coryphodons doubtless resembled those of the elephant in its shuffling and ambling gait, and may have been even more awkward from the inflexibility of the ankle. But in compensation for the probable lack of speed these animals were most formidably armed with tusks. These weapons, particularly those of the upper jaw, are more robust than those of the Carnivora, and generally more elongate, and attrition preserved rather than diminished their acuteness. The size of the species varied from that of a tapir to that of an ox.

We must suppose that the Coryphodons were vegetable feed-

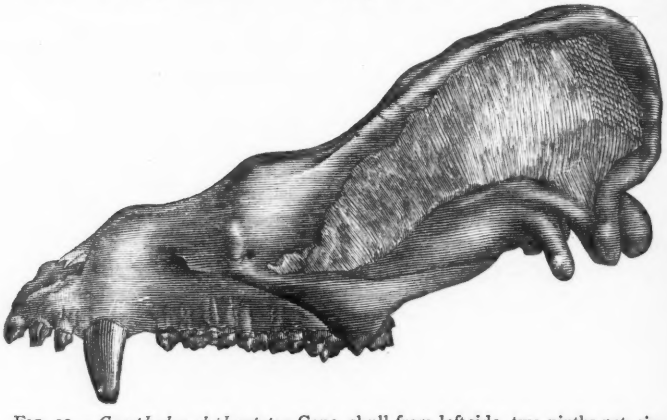

FIG. 21.—*Coryphodon elephantopus* Cope, skull from left side, two ninths nat. size. From Wasatch bed of New Mexico. Original, from Report U. S. G. G. Survey W. of 100th mer., Vol. IV, pt. II.

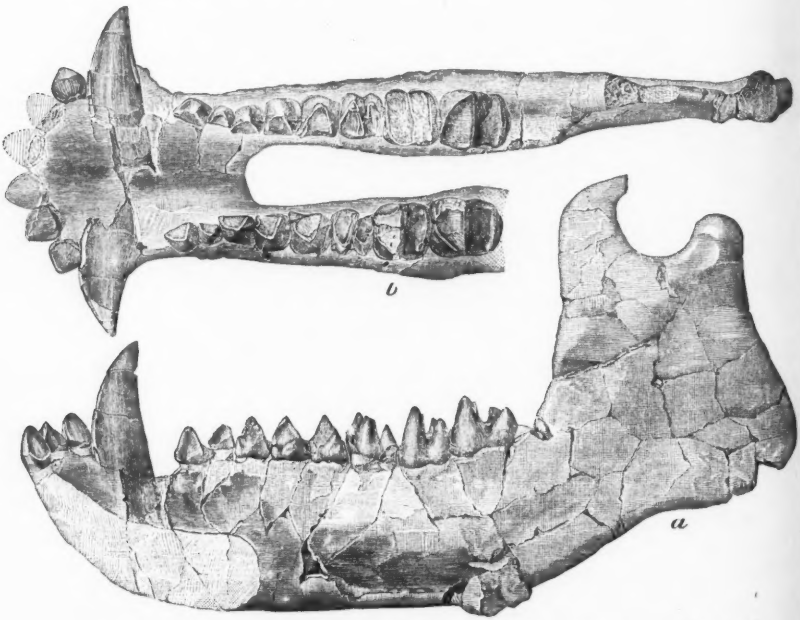

FIG. 22.—*Coryphodon latidens* Cope, lower jaw, one-third natural size, from the Wasatch epoch of New Mexico. Fig. *a*, right ramus from internal side. Fig. *b*, both rami from above. Original, from Report U. S. G. G. Surveys W. of 100th Mer., G. M. Wheeler in charge. This specimen has an anomalous premolar.

ers, but not restricted to any particular class of food. They were doubtless, to a large extent, like the hogs, omnivorous.

Fourteen species of this genus have been described. They range in size from the dimensions of a tapir to those of an ox. In the absence of the bones of the skeleton the species may be distinguished by the inferior true molars, which are fortunately the parts most frequently preserved. The simplest form is that where the posterior crest of the posterior true molar is transverse, and there is no crest or cusp accessory to it on the inner edge of the crown, as in *C. latidens* (Fig. 22). A change in the form of this crest is seen in the *C. curvicristis*, where it is curved forwards at the inner extremity so as to enclose a crescent-shaped valley. This species adds several other peculiarities of this tooth, as the presence of two oblique crests in front of the anterior cross-crest (Fig. 22). The superior incisors are angulate on the external face. The species was of about the same size as the *C. latidens*.

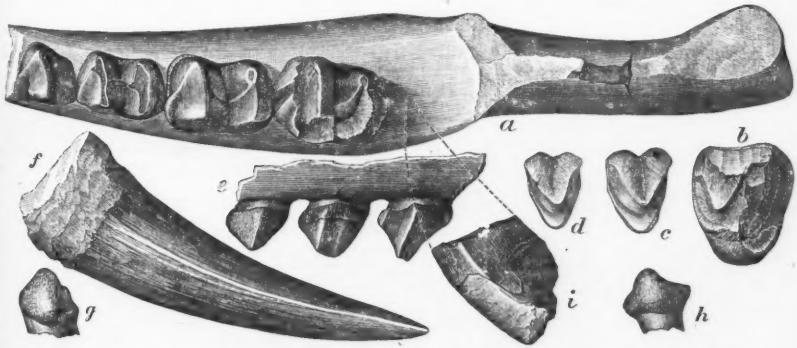

FIG. 22.—*Coryphodon curvicristis* Cope, portions of jaws with teeth, one half natural size, from the Wasatch bed of Wyoming. From Report U. S. Geolog. Survey Terrs., Vol. III. Original. Fig. *a*, right mandibular ramus with true molars and Pm. IV, from above. Fig. *b*, penultimate superior molar from below; *c d*, superior premolars from below; *e*, superior incisors, external side; *f*, superior canine, crown only; *g h*, inferior incisors, external views; *i*, inferior canine, base of crown.

The posterior cross-crest may send off the internal marginal crest at an angle, as in *C. eocœnus* Ow., or *C. obliquus* Cope. The internal marginal crest may rise into a low tubercle, as in *C. lobatus* or *C. anax* (Fig. 23 and 9 *b d*). In this case the posterior cross-crest may be very oblique, as in *C. anax*, thus giving the appearance of a heel or fifth lobe to the crown. This is indeed the character of such a crown, which if compared with that of the *C. latidens* only might suggest generic separation, but we

have every intermediate condition. Finally this internal ridge may develop into a conic cusp, as in the *C. cuspidatus* (Fig. 9 *e*).

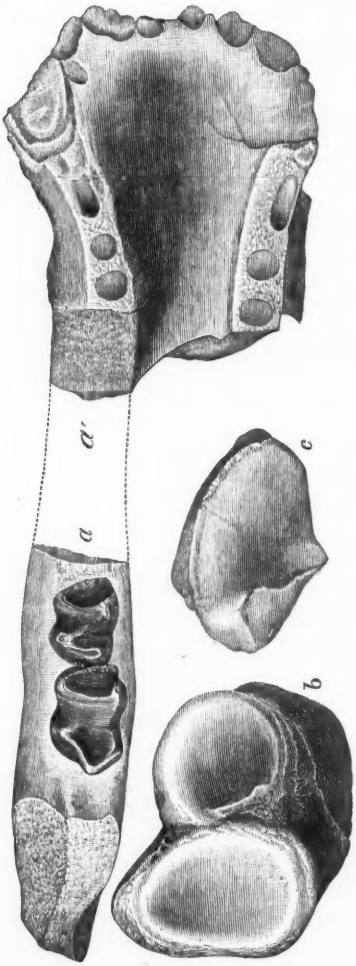

FIG. 23.—*Coryphodon anax* Cope, bones, two-fifths nat. size; individual represented in Fig. 9 *h*. From the Wasatch bed of Wyoming. Figs. *a a'*, mandible, less right ramus, viewed from above. Fig. *b*, head of tibia; *c*, distal extremity of tibia, end views. Original, from Report U. S. Geol. Survey Terrs., Vol. III, F. V. Hayden.

Of Metalophodon two species are known, the *M. testis* (Fig. 16 *b*) and *M. armatus* Cope, both from the Wasatch beds of Wyoming. Both species are of about the size of the *Coryphodon latidens*, and smaller than the *C. anax*. The skeletons are unknown.

(To be continued.)

THE RELATION OF COLOR TO FLAVOR IN FRUITS AND VEGETABLES.

BY EMMETT S. GOFF.

DURING the summer of 1882 I was struck by the coincidence that in several of our fruits and vegetables a white or light colored flesh is accompanied by a milder and more delicate flavor than exists in other varieties of the same fruit or vegetables having a dark colored flesh. Thus the white varieties of onion are milder in flavor than the red ones; the white currants possess less acidity than the red ones, and these in turn have less pungency than the black varieties; the white and yellow tomatoes are sweeter than the red ones; the white and yellow raspberries are more delicate in flavor than the red ones, and these in turn have a less strongly marked flavor than the black varieties. The familiar custom of blanching celery, endive, sea-kale, the cos lettuce and other plants to give them a more delicate flavor, was called to mind, and the fact that the inner leaves of the cabbage head which are white and decidedly more delicate in flavor than the outer green leaves; also that potato tubers "sun burned" through exposure to the light have a very strong and bitter taste. These and other instances came to mind, until I was led to ask whether there may not be a law of relation between the color and flavor in fruits and vegetables.

Every fruit and vegetable has a standard of quality peculiar to itself. This is based upon the natural qualities that make the fruit or vegetable desirable to man. Thus in most fruits quality is based upon delicacy and richness of flavor, with a certain degree of tenderness in the flesh. In many salads it is based upon crispness, tenderness and mildness in flavor; in a few, as the cress, it is based upon pungency. In some vegetables, as the potato and squash, quality depends upon the dryness and farinaceous properties of the flesh, combined with a delicate, characteristic flavor.

In the amelioration of fruits and vegetables, it is the constant aim of the horticulturist to intensify, so far as possible, the desirable qualities and to eliminate the undesirable ones. It is evident, therefore, that if it can be shown that the color of the flesh has a direct relation to its flavor and tenderness, we have a valuable index in the work of selection. If by whitening the flesh

of a fruit, through selection, we can eliminate acid and solidity, or if by darkening the flesh of another fruit, already too tender and insipid, in the same way, we can heighten its characteristic flavor, and increase its firmness, we have gained a new faculty in the work of making the products of nature subservient to our wants.

The hypothesis was therefore assumed, that in a white flesh, in fruits and vegetables, we escape solidity, and a strongly marked characteristic flavor, with a gain, or at least without a loss, of sweetness. This hypothesis was applied to the fruits and vegetables of which I have been able to find complete descriptions. The results of my researches will be given further on.

If the law exists which my hypothesis assumes, it is evident that the processes of selection have operated more or less to obliterate the marks by which it may be traced. Seedlings or sports yielding fruits having a very harsh or acid flavor have been rejected, whatever the color of their flesh. On the contrary, deep colored samples possessing a pleasant flavor, though exceptions to the law, have been preserved. Thus in many cases we are compelled to trace out the law with but half of the evidence. For example, the blood clingstone peach, which is said by Mr. Downing to have flesh "very red, like that of the beet," is pronounced "not fit for eating." Red fleshed peaches are very rarely mentioned in our fruit books. Possibly the reason why so few red fleshed varieties have been preserved is, that their flavor and firmness were such as to make them undesirable.

We may fairly assume that palatability has been a leading principle in selection, and that the color of flesh has had influence only in a few cases where appearance is of some importance. In the currant, the principal use of which is in the manufacture of jelly, the red color is preferable, because, as every one knows, the rich crimson color of jelly made from red currants is more attractive than the pale color of that made from the white currant, though it is equally well known the latter has decidedly the milder flavor. So in the beet and carrot, the rich colors of the deep red varieties of the one, and orange sorts of the other, are more desirable for the table than the paleness of the milder white varieties; and further, as there is no acid in these roots to overcome in their amelioration, their agreeable characteristic flavors are more developed in the deeper fleshed varieties. In the apple,

on the other hand, in which, as I think we may fairly assume, the factor which it was most necessary to eliminate in its amelioration is a harsh acid and an over-firmness, the majority of the varieties are white fleshed. So in the pear, we may assume that toughness and astringency were the qualities to be overcome, hence in this fruit we have mainly white fleshed varieties. In the plum and peach, however, in which the acid element is not very prominent, and which possess very little solidity by nature, we obtain higher characteristic flavors in the varieties having yellow or orange flesh.

Since adopting my hypothesis I have noted down such statements as I have chanced to find in horticultural reading, as bearing directly upon this subject. The extracts here recorded from several different authors seem to recognize the law as applying to special cases, but I have nowhere found evidence that any one has conceived it to be of general application.

In speaking of the leaf, or chard, beet, M. Henri Vilmorin says, in "Les Plantes Potagères," p. 422: "It seems that in all the leaf beets the white color of the leaves accompanies a sweet taste, while a deep green color is indicative of a strong and bitter taste."

In speaking of the turnip the same author recognizes a popular prejudice that white fleshed turnips are milder than those having yellow flesh, and which he is disposed to contradict. With all deference to this great horticulturist, I will say that the result of my own investigations, the detail of which I shall give further on, is confirmatory to the prejudice that he declares poorly founded. He says in the work just cited, p. 362: "It is certainly wrong that in Paris the yellow fleshed turnips should be less esteemed than others. It is here considered that the yellow color is accompanied with a strong and bitter taste, which is far from correct, for we find among the yellow turnips varieties possessing very tender flesh and of very delicate flavor, as well as in the white varieties." It will be observed that this statement does not contradict the existence of a greater proportionate number of mild flavored turnips among those that have white flesh.

Mr. Fearing Burr, Jr., says of red cabbages, in "Garden Vegetables," p. 142: "When cooked they are considered less mild and tender than the common varieties."

Regarding the comparative tenderness and delicacy of blanched

and green asparagus stems, Mr. Robinson, in his "Parks and Gardens of Paris," p. 472, quotes the opinion of a French epicure as follows: "In certain localities they do not yet value the distinction between blanched and green asparagus, and occasionally prefer the latter. That is an error very prejudicial to the consumer's interests. Properly blanched asparagus is infinitely more tender and delicate. All asparagus cut when it is green is not fit to be eaten in the ordinary way, but may be used, cut up small, as an accompaniment to other dishes. To serve up green asparagus is to dishonor the table. In the markets of Paris the green asparagus is worth one franc a bunch, when the blanched is worth three francs."

It has often been a question to my mind why the white beet is almost exclusively used in the manufacture of sugar. I had supposed that the difficulty of eliminating the color from the juice of the red beet to be the probable reason why the latter is not used for this purpose. I have been able to find very little bearing upon this subject, but that little indicates that the principal reason is that the white beet contains a larger percentage of sugar. Thus I find in Morton's "Cyclopædia of Agriculture," Vol. II, p. 925: "Formerly the field beet, with rose colored skin, and presenting, on being cut, alternate layers or zones of a white and a red color, was much more extensively grown in Germany and France for the purpose of sugar making than it is at present. Preference is now given to the White Silesian beet, introduced into France by Mathieu de Dombasle. The latter gives a larger percentage of sugar and contains less water, saline matters and nitrogenous substances than the former." According to M. Vilmorin, all the beets now used in France for the manufacture of sugar have been derived from the White Silesian variety.

In this connection I quote a partial analysis of three varieties of beet from the Transactions of the New York State Agricultural Society, 1852, p. 330. It notes the per cent of coloring matter and of the sugar and extract in each:

Variety.	*Per cent of Coloring Matter.*	*Per cent of Sugar and Extract.*
Turnip beet	.038	43.039
Long blood	.0158	55.327
White sugar		60.023

We may infer from this that the per cent of sugar in these

samples of beet increased as the per cent of coloring matter decreased.

In speaking of the leek, Mr. Wm. N. White says, in "Gardening for the South," p. 241: "The whole plant is much used in soups and stews, but the most delicate part is the blanched stems."

Mr. Charles Downing, in his admirable "Fruits and Fruit Trees of America," p. 629, says of the yellow fleshed peaches as grown under European climates, that they "require our hot summers to bring out their flavor. In a cold climate the acid is always prevalent." From the connection it is evident, as the reader may observe, that this is true especially of peaches having yellow, rather than "pale" flesh.

In speaking of the edible podded or sugar pea, the author of "Les Plantes Potagères" says (p. 423): "The seed of purple-flowered peas is always more or less colored or spotted with brown; it assumes a somewhat disagreeable grayish color when cooked, and has besides a rather strong and bitter taste."

In speaking of carrots the same author says, in "Le Bon Jardinier," 1882, Part 1, p. 437: "The red carrots have in general a more pungent taste than the yellow and white;" and again, on the same page, "the white carrots are esteemed for their sweetness."

Mr. Burr says of the Long White carrot: "Flesh white, and generally considered sweeter than that of the colored varieties."

In speaking of the mushroom, the author of "Les Plantes Potagères" says, on p. 82: "It seems to us, after several comparative trials, that the white variety is preferable to the others as a vegetable. The light-colored (blonde) variety appears to us less tender and perfumed [than the white], the gray has, on the contrary, a stronger taste."

Mr. Burr, in "Field and Garden Vegetables of America," p. 284, quotes the following in relation to the sea-kale: "These shoots form the edible portion, and being blanched under ground they are tender and white, and from six to eight inches long. The shoots should be cut as soon as they reach the surface, because if the shoot comes through, the top gets purple, and the plants become strong flavored."

The same author pronounces the blood red onion, in which not only the outer coats but the inner ones, except those most central, are stained red, "one of the strongest flavored of all varieties."

The large red is said to have "purplish white" flesh, and to be "stronger flavored than that of the yellow or earlier red varieties."

But of more value than all the testimony of impressions and quotations, is the result of a careful investigation of existing varieties. Do the varieties of fruits and vegetables, as described by unprejudiced horticulturists, when put to the test of figures, show clearly that mildness and sweetness accompany light colored flesh to a greater extent than dark colored? This is the test question. In the tables that follow, the testimony on the fruits is gathered mainly from Downing's "Fruits and Fruit Trees of America," and that on the vegetables from Burr's "Field and Garden Vegetables of America."

I have gathered in the table only such terms as express a definite quality, and which apply to my present purpose. Many terms are used, such as "delicious," "pleasant," "agreeable," "good," etc., which convey nothing specific in regard to flavor. Many shades of color are also delineated which are intermediate between the extremes, such as "greenish white," "yellowish white," "greenish yellow," etc. These I have not used, as the number of varieties to which they are applied is, in most cases, small, and they do not apply directly to the present purpose. Sometimes, for the purpose of simplifying the table and increasing the number of varieties, I have united two or more terms, which mean very nearly the same thing, into one. Thus the "deep yellow" as applied to the peach in the table, includes those described as "orange," "deep orange," "orange yellow," "rich yellow," etc.

In the table of vegetables the numbers are too small to make the testimony of much value, though so far as it goes the evidence is decidedly confirmatory to the hypothesis:

	Color of Flesh.	Number of Varieties.	Per cent "Sweet."	Per cent "Mild."	Per cent "Delicate."	Per cent "Tender."	Per cent "Melting."	Per cent "Juicy."	Per cent "Crisp."	Per cent "Firm."	Per cent "Rich."	Per cent "High flavored."	Per cent "Sub acid."	Per cent "Acid."
Apple	White	156	22	17	4	73	2	60	13	7	24	7	43	3
	Whitish	40	25	25	5	77	2	65	20	7½	20	0	55	5
	Yellowish	92	20	22	0	55	4	59	30	14	44	3	52	6
	Yellow	74	18	9	1	42	0	45	27	15	60	7	42	4
Pear	White	198	57	..	6	45	63	69	.	.....	23	25	35	..
	Whitish	51	49	..	0	0	82	78	..	.....	35	2	6	..
	Yellowish	16	38	..	0	0	81	63	..	.....	44	0	6	..
	Yellow	3	33	..	0	0	33	100	..	.....	33	33	0	..
Peach	White	21	33	..	5	..	71	81	..	5	43	24	sub-acid and acid	0
	Yellowish	22	60	..	0	..	14	45	..	14	45	9		14
	Yellow	73	52	..	0	..	18	52	..	7	33	4		8
	Deep yellow	26	23	..	0	..	15	42	..	8	27	4		15

	Color of Flesh.	Number of Varieties.	Per cent "sweet," "sugary."	Per cent "mild."	Per cent "delicate."	Per cent "well flavored."	Per cent "farinaceous," "mealy."	Per cent "dry."	Per cent "tender."	Per cent "fine grained."	Per cent "coarse."	Per cent "watery."	Per cent "strong."	Per cent "solid."
Potato	White	12	....	8	..	[1] 58	58	[2] 75	..	..	0	0	0	..
	Yellow	7	....	0	..	0	14	28	..	..	14	14	28	..
Turnip	White	13	100	16	..	..	..	..	50	53	..	..	..	38
	Yellow	8	75	0	..	..	..	..	46	25	..	..	..	25
Ruta baga	White	4	[3] 100	50	25	..	..	..	..	25	..	..	..	50
	Yellow	6	50	0	0	..	..	..	..	17	..	..	..	83

It will be observed that in every case where the terms "sweet," "mild," "delicate," "tender" and "melting" are used, the per-

[1] One was called "very well flavored."

[2] Of these one-third or twenty-five per cent were called "very dry."

[3] Two of these, or fifty per cent, were called "very sweet."

centage is highest in the white fleshed varieties. It appears also that the per cent of acidity is greater in varieties having dark colored flesh. In the pear the percentage called "sub-acid" is decidedly greatest in the white fleshed varieties. This may at first seem contradictory to my hypothesis. It should not be forgotten, however, that in the apple and pear a mild acidity greatly improves the flavor, and hence this apparent exception is possibly the result of selection.

In the plum no varieties are said to have white flesh. I find, however, that in five varieties in which the flesh is called "amber color," and three called "pale green," none are called acid; while in fifty-nine varieties called "yellow," five have some acid, in thirty-three called "greenish yellow," three are called acid, in twenty called "greenish," five are called acid, and in nine called "greenish yellow," three are called acid.

In the other fruits and vegetables I have not found sufficiently accurate descriptions to permit me to judge whether the hypothesis holds or not.

If further investigation should discover sufficient evidence in this direction to establish a law, this law will have an important practical application in the amelioration of fruits and vegetables.

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GROWTH, ITS CONDITIONS AND VARIATIONS.

BY CHARLES MORRIS.

(Continued from page 1101, November number.)

FAR back in the history of life we reach a period in which crustaceans and mollusks seem to have been the lords of the earth. During the greater part of the Palæozoic age the ocean invertebrates were dominant, they grew to great size, developed rapidly in functional ability, and swept the seas of their stores of food. We know little of the struggle which then took place between the various invertebrate sub-kingdoms, or of their probably successive rise to supremacy. Nor can we trace the struggle between the members of each sub-kingdom. So far as evidence goes the cephalopods would seem to have been contemporaneous in origin with humbler representatives of their race and of other races. But this is doubtless an illusion produced by an undue crowding together of the geological tablets.

This invertebrate era was succeeded by the earliest stage of

the vertebrate. The Palæozoic fishes appeared. At first they must have been inferior in size, weapons and food-getting power to their invertebrate rivals, who so long had ruled the sea. But their superiority of organization quickly told. They came into competition with their former superiors, and soon progressed beyond them, gaining massive armor of defence and strong reptilian teeth for attack. The empire of the seas had passed into new hands. These great ganoid and dipnoid fishes increased in size and strength, the invertebrate wave sank before them, and the lordship of the ocean became their own. The result was the same that has appeared in all such cases. They not only grew great in bulk, from the abundance of their food supply, but they varied with the greatest rapidity in specific character, assuming every variety of adaptation to their variety of food. This rapid specific variation of each type of life immediately after gaining the supremacy over preceding dominant types, is a fact which may be traced throughout the geological age, and indicates that variation in form and habits, while slow under ordinary conditions, may be extremely rapid under such specially favoring circumstances.[1]

These early dominant fish, while superior in power to all preceding animals, were inferior to those that succeeded them in the fact that they trusted for defence to massive armor instead of to speed. In the whole history of life trust to armor has been an inferior characteristic, the armored animals have tended to grow more sluggish, and in most cases to assume a sedentary life, while all steps of higher development have been attained by the less weighted and swifter moving animals. Such is the story of ocean life. As we enter the Mesozoic age unarmored reptiles succeed to the armored ganoids and quickly take from them the empire of the seas. The duplex characteristics of the Palæozoic fishes seem to divide, developing in one direction into the more efficient reptiles, and in the other into the teleostean fishes, which are well adapted to obtain food from the humbler life of the sea. The only continuous representative of the earlier dominant fishes is the shark, which had cast off its excess weight and thus became able to contest the field with the swimming reptiles, and even to survive them. But the immense size attained by these

[1] For the details of this hypothesis see paper by Alpheus Hyatt, *Science*, Nos. 52 and 53.

reptiles, and their rapid variation in specific character, indicate their superiority over all the remaining ocean life of their period, the abundant food which they obtained with little effort, and the variety in organization and methods of escape of this food, which necessitated accordant variations in its foes.

While these revolutions were taking place in the empire of the seas, life had invaded the land. Insects were the first animal inhabitants of the land, so far as evidence goes. They gained no extreme size, perhaps through a paucity of food supply and organic inefficiency. Yet land articulates seem to have rapidly increased in variety, since spiders, scorpions and myriapods appear almost contemporaneously with insects. At the same period, or shortly afterwards, ocean vertebrates invaded the land. The character of their invasion singularly resembles that of the articulates. The latter were obviously derived from water articulates, since the first known forms belong to those families which pass their larval period in the water. In like manner the earliest land vertebrates were batrachians, which in their larval state are water animals. These creatures seem to have found a free field and abundant food, and to have multiplied and varied with great rapidity, while some of them attained great bulk despite their imperfect organization. Cope gives a list of thirty-nine genera and about a hundred species of Carboniferous batrachians, which indicates that the full degree of specific variation was very great. In fact they seem to have had the world of the land to themselves, with nothing but the imperfection of their organization to hinder their obtaining superabundant food with little exertion, and thus growing to immense size.

This age of batrachian dominance was succeeded by one in which the wave of batrachian life declined, while huge land animals took their place on the throne of the empire of life. The batrachians were unfitted to compete with reptiles in the struggle for food, and were obliged to content themselves with lesser supplies, so that they quickly diminished in size before the onset of their strong competitors. Very probably personal assault from these new-comers, as they grew stronger and able to cope with the batrachians, hastened the decline of the latter, and drove them down into the humbler fields of life.

And now came a new life era. The land reptiles increased in number and variety with the seeming suddenness of all preceding

dominant forms, and grew in many instances to enormous bulk, far exceeding anything previously known among the inhabitants of the land. Step by step the animal world was learning the art of food taking. The lesson was slowly learned. The two energies of escape and pursuit kept pace in development, each forcing the other upwards. The continued effort at escape or defence must have yielded steadily greater efficiency and variety. This in its turn rendered necessary the development of new and more efficient weapons and methods of assault. Thus has life been pushed ever upward, the Carnivora forcing their living food to superior development, and the food animals exerting a like influence upon their carnivorous foes throughout the whole long reign of earthly life.

But as in all preceding eras of life, during this age of reptiles their destined successors to dominion were slowly developing, in lowly forms, far below the huge reptilian monarchs. True birds gradually developed, and the flying reptiles disappeared before them. The feather proved superior to the membrane as a flying organ, and in the competition for food which succeeded, the membrane-winged creatures vanished. At a later period other membrane flyers, of mammalian organization, came into competition with the feathered tribe. But they have failed to dispossess them. The bats have been restricted to a nocturnal life, and the birds still hold the diurnal empire of the air.

Such was not the case with the mammalian occupants of the other two fields of life, the land and the sea. Before their onset the wave of reptilian life rapidly sunk, and that of mammalian life as rapidly rose. This advance of the Mammalia to supremacy seems to have been a slow one, and was probably hotly contested by the strongly-armed, swift-moving and huge-sized reptiles. But as in all cases, a superior organization eventually won the battle. The earliest mammals were of the lowly-organized marsupial type. They seem to have been incompetent to cope with the powerful and vigorous reptiles, and after their first appearance, vanish from sight throughout the long period of the Cretaceous era. They probably continued too insignificant to leave any strongly declared marks of their existence in the rocks.

Just how or when the placental mammals appeared, we are ignorant. But their unquestionable superiority to the reptiles in

organization quickly made itself manifest. The reptiles sunk and the mammals rose to the supremacy with such seeming suddenness that it appears almost the work of miracle. Of the hard battle for empire which must have taken place, not a trace remains. We step from the Cretaceous to the Eocene era, and at once we pass from a world ruled by huge reptiles into one controlled by equally huge mammals. The wave of reptilian life rapidly declined, while that of mammalian life broke over it. The former imperial rulers of land and sea sunk into lowly creeping and lurking forms, while the new lords of life grew into swimming and stalking monsters of unquestioned superiority.

It is not probable that this change took place as the consequence of an actual battle between reptiles and mammals. More likely it resulted from a sharp competition for food, in which the mammals gained the victory, the more specialized great reptiles dying out through starvation, while the generalized forms decreased rapidly in bulk and gained new habits.

In regard to this superiority of mammals over reptiles one of its most important features was the hot-blooded organization of the former as compared with the cold-blooded condition of the latter. The result of this condition was to make the reptiles essentially tropical in habitat. Such forms as ventured into colder regions must have hibernated in the winter, and thus could not well have attained any extreme bulk. Hibernation was not necessary to mammals. This fact at once gave them a superiority in colder climates, in which they could develop unopposed, and from which they could descend to the tropics in bulky and vigorous forms to compete with their reptilian predecessors for the food supply.

As for the oceanic mammals, it is not impossible that they also gained their early development in colder regions, which many of them continue to inhabit, and thence pressed southward to compete with the great ocean reptiles. The huge toothed whales of the early mammalian period, typified by the gigantic Zeuglodon, probably were particularly well adapted to obtain food, and may have rapidly swept away the food supply of their predecessors. In this connection there is one point of the greatest importance, to which we have as yet made no allusion, though it doubtless was strongly influential in causing sudden replacements of old by new forms of life. If the competition between old and new types

was less one of personal battle than of success in obtaining food from a common source, then it does not appear at first sight evident why the different dominant types should not have overlapped, the great reptiles, for instance, continuing into the Eocene instead of completely abandoning the field to the mammals.

There is a probable cause of this, to which no attention has hitherto been called, yet which may have been amply sufficient in all such cases. Thus the great carnivorous oceanic reptiles pursued prey which they must have found continually greater difficulty in capturing. The easily taken forms either vanished or changed in organization and habits, growing smaller, swifter, and more wary. They also became continually better adapted to the modes of attack of their foes, so that the difficulty of the latter in obtaining sufficient food for their needs must have steadily increased, and a retrograde movement in size and numbers have arisen. Under such circumstances a new-comer, which had attained size and strength in another region, must have possessed a peculiar advantage. The swimming food had learned the art of self defence or escape from its older foes, but lay helpless before this new foe, to whose mode of attack it was not accustomed. Such a new-comer would therefore be able to make fierce havoc in the ranks of the food animals, and rapidly cut down the harvest. It would tend to a rapid increase in bulk and strength, while its older competitors must shrink in size or perish, starved out of existence. Even when otherwise equal in organization the new-comer would have an immense advantage in the lack of adaptation of the food to its weapons and methods of assault. It is perhaps largely due to this cause that sudden successions in reptilian forms, and in the dominant forms of other types, took place. New forms came from distant regions and robbed the indigenous forms of the bulk of the food. But when to this advantage was added that of a superior organization, as of reptiles over batrachians and of mammals over reptiles, the earlier forms would be supplanted yet more rapidly and completely, and changes in the dominant forms of great suddenness might take place.

To this cause of the numerous apparently sudden replacements of old forms by newer, unrelated forms in geological times, may be added another, which refers to a similar rapid replacement of related forms. The case so far described is that in which a dom-

inant form of animals was replaced by another form of different type which had been slowly growing up beneath it, or more probably had migrated from another locality into one whose food animals were helpless before its assault. But there is another case of extreme importance, that of the apparently sudden replacement of one species by another of the same genus or family, usually of superior organization, with no trace of steps of succession from the one form to the other. This absence of link-forms between closely related species is one of the most marked characteristics of palæontological evidence, and seems to strongly hint at specific succession by leaps instead of by minute steps. Yet the question of food supply yields one argument in favor of the latter which may be here given.

A replacement of one species by another indicates that the second is in some way better adapted to the existing conditions of nature, or to new ones which have arisen. In other words, it is suited to obtain more food with equal exertion, or equal food with less exertion. But the competition which arises is stronger and closer between the offspring and the parental form than between diverse forms. The two related forms are adapted to the same kinds of food, and are closely similar in weapons and habits. Hence of all forms of animal life the one which is put most at disadvantage by the food taking ability of a new form is its parental form. Other tribes of different organization and habits come less into competition with it, or at less disadvantage. If adapted to an entirely different food there is no competition.

Thus two important results are likely to spring from the evolution of a new animal form, specially well adapted to the food conditions of surrounding nature, or possessed of a variety of weapon or habit of assault to which the food has gained no defensive adaptation. One of these results must be the rapid disappearance of the parental form, which will be starved out of existence. And if there be several successive link-forms, each must rapidly yield to its successor. Thus if a considerable or rapid change of natural conditions necessitates a similar rapid succession of specific variations in some animal tribe, not only the original form would vanish, but the link forms would quickly disappear. The new dominant form would tread down its steps of advancement, and the intermediate forms, having a comparatively short term of existence, and giving rise to comparatively few in-

dividuals, would be very unlikely to leave a geological record of their existence. This perhaps is one important cause of that marked absence of link-forms between related species which has given rise to so much controversy.

The effect of this influence upon animals of different type, but subsisting on similar food, would probably be of a different character. While acting to crowd out older forms it might also instigate specific variation, and the evolution of new organs and habits. Thus progress in any one type might powerfully tend to cause progress in other types, and new species evolve simultaneously in several unrelated types, through the action of a single initial force.

As to the succession of huge Mammalia in the Tertiary age, little need be said beyond the considerations already taken. One important fact appears, that the greater land Mammalia were Herbivora, a fact in opposition to that which appears in the case of air and ocean animals, in which elements the Carnivora have always held the supremacy in size. The reason for this we have considered in the case of the birds. As for the ocean animals it naturally arises from the fact that in the ocean animal food is far more abundant and nutritious than vegetable. On the land the opposite conditions rule. Vegetable food is more abundant, while animal food can only be obtained with greater exertion than is required in the water. Hence we find the land Herbivora steadily tending to exceed the Carnivora in size. This is not the case with those timid Herbivora which seek safety in flight, and thus exhaust tissue by great muscular effort. But as soon as a grass or leaf-eating animal grew strong and bold enough to resist and fight off carnivorous foes, the diminished exertion required and the greater time for nutrition, enabled it to increase in size and to quickly grow too powerful to dread the strongest Carnivora.

This result we find occasionally even among the ordinarily timid deer, as in their extinct relative, the gigantic Sivatherium. Of the other huge forms it will suffice to mention the mighty stalking Dinosauria of the reptilian age, whose biped attitude must have aided them to a superabundant supply of leaf food; and the elephantoid mammalian type whose superior organization enabled them to persistently survive and to evolve successively better adapted forms, while other types swelled into hugeness shrank again and disappeared beside them.

We cannot undertake here to consider the various huge creatures which successively appeared and vanished, with the probable cause of their success. It is simply our purpose to generally illustrate the principles of growth already reviewed. A brief reference to the vegetable kingdom, however, is here of some importance. In this kingdom nutriment is not consumed in producing muscular, nervous or temperature vigor, and reproductive energy alone competes with growth vigor. In vegetables, as in animals, those that employ most nutriment in reproduction attain the least size. The trees which bear juicy fruits, and which thus lay up a large stock of protoplasm for the use of their offspring, are smaller and shorter lived than the nut-bearing, and these again than the seed-bearing.

Also in vegetables as in animals the size is greatly affected by the degree of efficiency in food-taking, and by the character of the embryological development. The spore-bearing plants, the ferns, mosses, &c., yield cases of larval birth. The young needs to pass through a phase of metamorphosis which consumes much of its initial growth energy. Other facts in this connection are the following: Plants which are prevented from seeding are longer lived and grow to greater bulk. On the contrary, those which flower early die young, and the cultivation of fruit trees for early and extreme bearing shortens their lives.

Again, plants of imperfect organization often attain great size in situations of high temperature, abundant nutrition and decreased reproduction. Such is the case with the tree ferns of the tropics, and such was the case with the many huge plant forms of low organization in the Carboniferous age of geology. In this respect plants present phenomena somewhat parallel with those of animal life. With the appearance of the exogens began a retreat of the endogens and the lower forms. While palms, ferns and other low forms have been able to hold their own in the tropics, the exogenous trees have gained the supremacy in colder climates. In these regions the competition for food has been decidedly in favor of the exogens, the endogens have sunk into the lowly grasses, and the ferns into feeble inmates of damp situations. Even the more hardy conifers have been driven back before the march of the exogens, and have retreated to the marshes and the cold and partly barren mountain sides, where the character of their organization seems to give them an advan-

tage over their rivals. The nutritive superiority of exogens over endogens and ferns probably arises from their habit of laying up each year an excess stock of nutriment for employment in the early periods of the succeeding year. This relieves them from the necessity of bearing their heavy covering of leaves throughout the storms of winter, and gives them a decided advantage in cold climates over evergreen plants. As for the conifers, they have reduced their leaves to needles, probably for protection against the destructive action of winter storms.

We have one other matter to consider in conclusion. One of the most striking phenomena of palæontological history is the disappearance of most of the great Herbivora and Carnivora with the advent of the Quaternary epoch. Such has not been the case in the air and the water. The whale and the condor have probably never been surpassed in size in their respective fields. Significantly this disappearance on land is closely related to the coming of man. It might appear as if man, with his superior weapons and powers, had been the moving force in this phenomenon. Yet such can hardly have been the case. Man did not come into destructive competition for food with these larger animals, and not at all with the grass and leaf-eating tribes. He may have slaughtered many, both of the Herbivora and the Carnivora, yet he could hardly, in his early days, have greatly diminished their numbers in this manner. For the changes which took place other causes must be sought, and probably the most vigorous of these was the radical changes in climate which took place at this period. Many of the greater animals, incited perhaps by the existence of partly tropical conditions in the temperate regions, had made their way far to the north. On these came down the chill of the glacial epoch, whose influence must have made itself felt even throughout the tropics, and which caused a general change of condition that must have been greatly destructive of animal life, and particularly of the bulkier and more sluggish forms.

After the icy period passed and genial conditions again appeared, the land animals were found to have markedly decreased in bulk. The present elephant succeeded to the gigantic mastodons and mammoths as the greatest of the land animal kind. And with it man had fully disseminated himself over the earth, a new dominant form whose advent put a final and decided check

to the development of any new herbivorous monster. Man needs the earth for himself; he demands the bulk of the food; and the older dominant forms of the lower kingdom of animals are steadily declining and disappearing before his destructive vigor and successful food competition.

Some remarks in regard to the size of man are pertinent in conclusion. The human type, if derived from the Quadrumana, has, like several other animal tribes whose fossil progenitors have recently been discovered, steadily increased in size. The lower Quadrumana are arboreal in habit, and are necessarily restricted in size by the exigencies of their active life. Those which have left the trees for the earth have diverged in two directions, towards the essentially quadruped baboon, and the nearly biped anthropomorphic ape. To the latter the human biped is most nearly related. But the superior organization and powers of man have not resulted in an increase in bulk over the great apes. There has been rather a diminution. And this may have arisen from the great muscular activity and mental energy of man, necessitated in his migratory outspreading over the earth, and his incessant conflict with the lower animals, to which the tropical forest life of the modern great apes makes no demand.

If we consider man in his civilized state no lack of activity appears. The muscular is merely replaced in great measure by active mental energy. Food has grown abundant, but is not superabundant with the great mass of the people of any nation. The share of food obtained by the active farmer, for instance, is much less than that obtained by the sluggish ox in his field. Thus the present average size of man is doubtless partly governed by the average quantity of food which each man can obtain. There is some reason to believe that man to-day is of greater bulk than was the man of the middle ages. The food supply for each man is certainly greater than then. It might be argued that by a decrease in the number of men, under present conditions, an increase in the food supply of each and, therefore, in the average size might be produced, yet any such variation can only take place with extreme slowness. As man now exists his size is in harmonious relation with the conditions of his existence, and cannot be rapidly departed from. In addition to the growth-restraining energies of muscular and mental activity, the reproductive capacity is such that there is a constant tendency to crowd

the field of life and diminish the average supply of food. This is, as yet, obviated by the augmentation of the food supply through human labor, which has, for a long period, caused a steadily increasing ratio of food to consumers. Thus the increase both of leisure and of food supply of civilized man favors an increased growth vigor. If in the future of civilization human fecundity should decrease, as it shows some indications of doing, the size and length of life of man might markedly increase, and the development of the individual gain upon the reproduction of the race.

Hereditary influences act strongly to prevent deviation from any established standard. Yet the leveling effects of heredity are constantly opposed by energies of variation. These seem to be of two kinds, variation by the preservation of minute increments, and by considerable leaps of change. The Darwinian theory of specific variation trusts solely to the former, yet the opposing facts it has to overcome are so many and vigorous, and the palæontological evidence is so strongly in favor of considerable variations, that the idea of leaps from species to species is steadily gaining strength.

The same considerations hold in regard to size variation. It may arise from minute changes, or from the preservation of considerable leaps. Slight variations in size are universal, but leaps to giant or dwarf individuals are not uncommon. With the lower animals it is quite possible that these great variations in size, when in harmony with suddenly changed surrounding conditions, may have been occasionally hereditarily preserved, and rapid growth or diminution in bulk of a tribe of animals have taken place. In man such abnormal variations can scarcely become dominant. Human agency has so succeeded in equalizing the food supply, and in restraining the tendency of outer nature to variation, that conditions vigorously aiding the preservation of a giant or dwarf race are unlikely to arise. The mental force of prejudice is also more strongly active against such a change in man than in the lower animals. Thus human variation in size is more likely to be in accordance with the Darwinian law, of preservation of minute increments of change, in correlation with slowly varying conditions, alike in the food supply, the exertion necessary to obtain it, and the reproductive energy. Giant and dwarf races at present exist in certain regions of the earth, probably produced

in this slow manner, but civilized man everywhere tends to a close conformity in size, as he also does in conditions of existence. Thus any future change in the average size of man must be of very slow evolution. Its direction will probably be towards greater bulk.

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PRELIMINARY NOTE ON SOME FOSSIL FISHES RECENTLY DISCOVERED IN THE SILURIAN ROCKS OF NORTH AMERICA.

BY PROFESSOR E. W. CLAYPOLE.

I.

THE lowest Old Red Sandstone of Scotland, the argillaceous slates of Cornwall and the calcareo-argillaceous beds of Ludlow in England, have furnished the most ancient fossils yet published which can be attributed to the class of fish. The first and second of these horizons are included in the Devonian system, the third, which is also the most ancient, forms the upper part of the Silurian.

Except two species of Onchus (*O. murchisoni* and *O. tenuistriatus*) all these fossils are referred to the abnormal family of Cephalaspids—a family so abnormal that some zoölogists have seriously doubted if its members were really entitled to the name of fishes. But evidence recently obtained has, in the opinion of those who have specially studied them, Professors Huxley and Lankester, satisfactorily settled the question in their favor, and they are now, with general consent, retained among the vertebrates, of which they form the most ancient type hitherto recognized.

Fossil fish have been reported from rocks called Silurian in Bohemia and in Russia, but the genera and species present an aspect so decidedly Devonian, judging by the English strata, that it is not easy to correlate the two. Asterolepis, Gompholepis, Coccosteus and Ctenacanthus can scarcely be paralleled with the more primitive types of the English Ludlow above alluded to.

No species of fish has yet been published from the Silurian rocks of America, or even from the Lowest Devonian. The most ancient fossils of this class which the western continent has yielded have been found in the Corniferous limestone of Ohio and the beds at Campbellton near Gaspé in Canada. Of these the latter is probably rather the older of the two, as it contains

Cephalaspis, which has not yet been reported from the former locality. The two species known are: *Cephalaspis dawsoni*, *Cephalaspis campbelltonensis.*

During my recent work on the palæontology of Pennsylvania I found some fossils much resembling the well-known specimens from the "Ludlow beds" of England, which for fifty years have been the oldest known fishes. They were an Onchus and two kinds of shields very close in outward form to the Scaphaspis of Lankester.

The study of these fossils has proved that this resemblance is not merely superficial, and that there unquestionably existed, both in Pennsylvania and in England, similar species of fish which characterized the Upper Silurian era in both continents.

The shield, like that of Scaphaspis, as described and figured by Huxley (*Q. J. G. S.*, Aug., 1858), consists of three layers. The inner layer is thin and homogeneous, having a thickness of about $\frac{1}{240}$ of an inch. On this reposes a cellular layer about $\frac{1}{80}$ of an inch in thickness, the walls of which are composed of the same material. These cells open on the interior surface by round pores which traverse their floor, that is, which pass through the inferior layer of the shield. The cells also communicate by openings in their covering layer with a system of canals lying above them.

The outer layer has a thickness of about $\frac{1}{120}$ of an inch, and is composed of the same material as the two already described. It is traversed from end to end by two systems of vessels of which the lower is immediately above the cellular layer, with which it communicates by the openings above mentioned. The canals of this system have a diameter of about $\frac{1}{240}$ of an inch, and from their sides issue branches almost as large as themselves. These branches communicate with another system of canals (or furrows) a little above them and rather less in size, running parallel with them from end to end of the shield under the superficial striation.

Connected with the former of the two systems of canals, and springing from its upper surface, is a delicate and beautiful thicket of minute branching tubules, becoming continually smaller and smaller until they terminate at the outer surface of the shield. Under the microscope they stand out distinctly in black on the transparent background of the material which composes the lay-

ers and present a beautiful spectacle with an objective of a fourth or a fifth of an inch.

This description coincides in all details of importance with those given by Professor Huxley in his figure of Scaphaspis. But in several minor points of structure there are differences which make it doubtful if the specimens here described can be referred to that genus. The most conspicuous of these is the regularity and parallelism of the vessels in the outer layer, a feature not shown in any already described species of Pteraspid, so far as I have been able to ascertain. This and some other distinctive features have induced me to place them in a new genus under the name of Palæaspis, in which they constitute two species: *Palæaspis americana*, *Palæaspis bitruncata*.

Accepting the usual correlation of the Upper Silurian rocks of Britain and America, according to which the Ludlow rocks are the stratigraphic and palæontologic equivalents of the Lower Helderberg, the lowest bed of the latter, the Water Lime must lie on the horizon of the English Lower Ludlow. The last is the lowest fish-bearing stratum known in Europe, and has thus far yielded only a single specimen. This, the earliest vertebrate fossil hitherto known, is, as Lankester remarks, enormously older than its kindred fossils from the Upper Ludlow, the bone bed of which has yielded numerous specimens both of the same species (*Scaphaspis ludensis*) and of others.

The fossils above mentioned were found in a stratum which, in my report on the geology of Perry county, now in the press, I have named the "Bloomfield sandstone." It lies at the top of the variegated shale or marl, the middle portion of the great mass of the Onondaga. This—the upper part of the fifth group of Rogers in the first survey of Pennsylvania—is about 1500 feet thick and almost barren of fossils. The only species, excepting those here described, with which I have met in the county, is the well-known crustacean, *Leperditia alta*. This shale is divided into three parts:

Lower Helderberg, water lime.

Onondaga....	Gray marl	200 feet.
	Variegated marl	700 "
	Red shale	700 "

The "Bloomfield sandstone" consists of a series of thin red and gray beds separating the variegated from the gray marl. The fossils have not been found generally diffused over the exposure

of the rock in the county but in only a few places. Probably if it were more accessible they would prove to be more abundant. They are seldom in a good state of preservation, but fragments capable of exhibiting the structure are abundant in some places.

From the above facts it may be inferred that the Pennsylvania fossil, Palæaspis, is somewhat older than the unique *Scaphaspis ludensis* of the English Lower Ludlow, and therefore considerably older than the specimens of Scaphaspis and Cyathaspis? that have been found in the Upper Ludlow.

A thousand feet lower down, in the middle of the red shale, I have met with a thin bed full of comminuted fish-scales or shields resembling in many points those of Palæaspis. Their matrix presents some resemblance to coprolites, but their condition is too imperfect to allow of description.

Nor is this quite the whole. Five hundred feet lower still, below beds indisputably of Clinton age, as determined by their fossils, among which are *Calymene clintoni*, *Beyrichia lata*, *Hormoceras vertebratum*, lies the well-known iron sandstone of the Clinton group of Pennsylvania. In this is a thin layer thickly charged with comminuted scales in much better condition than those in the red shale. With these occurs a spine somewhat like those from the Bloomfield sandstone, and which I have named *Onchus clintoni*.

Associated with these are great numbers of small pellets which present all the characters of coprolites, and may be referred almost with certainty to that group of objects, being in great part composed of phosphate of lime.

It is evident that in these fossils we have the most ancient relics of vertebrate life yet known from any part of the world. At the same time, though carrying the existence of fishes down through at least 1500 feet of strata and back through a corresponding lapse of time, it must be added that these fossils do little or nothing to bridge over the chasm existing between the vertebrates and the invertebrates. Odd and aberrant from the type as they are, they cannot logically be excluded from the class of fish, and though we know nothing of their soft parts, it is reasonable to believe they were arranged as in their nearest allies of which we know anything, Cephalaspis and Coccosteus.

Yet on the other hand, though these particular fossils throw no light on the connection between vertebrates and invertebrates, it is an indisputable fact that the whole group to which they be-

long, including Pteraspis, Cyathaspis, Scaphaspis and Palæaspis is marked off by a remarkable peculiarity of structure from every known vertebrate animal. So conspicuous is this character that by its aid we are able to distinguish the smallest fragment of their bony shields from all other bone whatever. Not a trace can be seen in them of the peculiar structure which to the anatomist characterizes true bony tissue. The bone cells (lacunæ) and the tubules (canaliculi) connecting them are totally absent. Nor can the Haversian canals, which are usually present in bone, be discovered. So important is this fact that the unwillingness of some naturalists to admit them among vertebrates was natural and defensible. Nor was this unwillingness overcome until the discovery of a specimen showing a few scales attached to the matrix behind the shield afforded indisputable proof of their ichthyic affinity.

The profound significance of this fact has not yet, it appears to me, been fully appreciated by systematists, nor has the fact itself received the recognition to which it appears to be entitled. Probably the obscurity in which these organisms have been hidden, their imperfection and their local and individual scarcity have contributed to bring about this result. Yet it is hard to avoid the conviction that in this immense anatomical difference there may be concealed at least one stone of the bridge that shall some day span the gulf now separating the vertebrates and invertebrates, and that in this approximation to a simpler structure we may see a link between the highly complex tissue of true bone and that simpler and more homogeneous material of which the hard parts of animals lower in the scale are composed. It can be but one link; others would still be wanting. The relative positions of the hæmal and neural elements would present the same difficulty, and the riddle propounded by these will perhaps be never read, as the soft parts are not likely to be preserved.

In thus carrying down the remains of fish almost to the base of the Upper Silurian rocks, it becomes evident that we must seek in some part of our Cambro-silurian series to find yet earlier forms. It is not likely that these are the first that existed. Lower beds must be searched. Pander's "Conodonts" may yet take their place among vertebrates, and fossils older than they may come to light before we can say we have found "the missing link," if such ever existed—the Ichthyic Archetype.

THE HARP SEAL A PERMANENT RESIDENT IN THE ST. LAWRENCE.

BY C. HART MERRIAM, M.D.

THE harp seal (*Phoca grœnlandica*) is a circumpolar species abounding in the northern seas at certain times of the year and coming south in winter as far as the Grand Banks of the North Atlantic.

It is an off-shore species, living in the open sea or among the ice, and rarely approaches land excepting for the procurement of food under certain special circumstances hereinafter detailed. I am not aware that it ever crawls upon rocky ledges, or even sand bars, as does the harbor seal (*Phoca vitulina*) and several other species.

During the season of bringing forth and caring for its young, which occupies nearly two months (usually from the middle or latter part of February till the middle of April), vast multitudes of harp seals congregate on the ice fields around Jan Mayen island, and on the drifting floes to the north and east of Newfoundland. The fact is also well known that large numbers regularly whelp on the ice in the Gulf of St. Lawrence, but these are supposed to be a branch of the main herd which has passed southward through the Straits of Belleisle, while the main body passed to the eastward of Newfoundland. On this point Mr. J. A. Allen, in his excellent monograph of the Pinnipeds, observes: "Their passage southward along the Labrador coast occurs before the ice forms, and during this journey they are said to 'hug the shore' and freely enter the gulfs and bays. They appear first in small detachments of half a dozen to a score or more individuals; these are soon followed by larger companies, which increase in frequency and numbers; in a few days they form one continuous procession, filling the sea as far as the eye can reach. Floating with the arctic current, their progress is extremely rapid, and in one short week the whole multitude has passed. Arriving at the Straits of Belleisle, the great body is deflected eastward, but many enter the straits and pass round to the southward of Newfoundland; some, however, spend the winter in the Gulf of St. Lawrence, where they bring forth their young on the ice in spring" (pp. 642–643). But neither this author nor any other writer, so far as I am aware, has intimated that the species in question might be found in any part of the St. Lawrence after the

close of the breeding season. In fact, authorities agree that its range, in these waters, is limited to the lower gulf, from Anticosti, the Magdalens, and St. Paul's island, outward; and that it is found here during the winter months only.

In cruising about in the river and gulf during the summers of 1881 and 1882, I saw many seals. Some were evidently the harbor seal (*Phoca vitulina*), while others were too large for this species. On one occasion in particular, a stormy afternoon in July (July 19, 1881), not far below the mouth of the Saguenay, a large seal with a perfectly black head appeared alongside our yacht and rode over several waves before lost to view. Others of the same kind were seen off Portneuf and Manicougan, and between Anticosti and Mingan. Mr. Napoleon A. Comeau, who lives on the north shore near the point where the river expands into the gulf, assured me that the seal in question was the harp, and that he had killed hundreds of them during a residence of more than twenty years on that coast. Mr. Comeau has since sent me, and I have now in my possession, nearly fifty skulls and several skins of harp seals killed between Manicougan shoals and Pt. des Monts. The greater number were shot in March and April, though some were taken in the middle of summer. During the present season (1884), he shot one June 16th and another September 8th, the latter containing a fœtus 55^{mm} in length.

Mr. Comeau has kindly furnished me with the following interesting notes:

"The harp or Greenland seal (*Phoca grœnlandica*) is the most abundant of all our seals, roving up and down the St. Lawrence in its migrations in immense numbers. It is eminently gregarious, hundreds and even thousands being seen together. I myself (in March) have observed one herd at Point des Monts that was more than a mile long; there must have been several thousand in it. They are to be met with at all seasons here, but are most numerous in winter, especially in December, January and the early part of February, at which time they disappear and resort to the ice-fields in the gulf for the purpose of depositing their young, which they begin to do about the 15th of February. As in the case of the harbor seal, the young are perfectly white at birth and have a fine silky coat about an inch in length. If killed soon after birth, or within two or three days, this fur is very fine; but if a longer time has elapsed, especially if the weather

be fine, it falls off quickly and the true hair and color is assumed. When one year old the color is whitish underneath, with occasionally a few black spots, about the size of a ten cent piece, about the neck and breast. These spots are not always present, the color very often being uniform dirty white. On the back there is a broad streak of grayish or blackish color. In the second year there is a slight change. The markings are more numerous, and *are never absent*, the black spots are also larger and more generally distributed all over the body, and the color of the back is not quite so dark or uniform. Third year: most of the black spots having enlarged are merged into each other and form large irregular patches about the size of hen's eggs or slightly larger. The color of these spots also begins to fade, and they have not the same clearness of outline. A few occasionally bring forth at this age, but it is very rare. By the fourth year they have attained nearly their full size, and the two peculiar stripes on the back, from which they derive their name (as it resembles a harp in shape), begin to appear; the other spots disappear gradually in proportion as these stripes become more distinct and perfect, until at such time, probably at the age of nine or ten years, these two bars and part of the back of the head and nose only are black, all the rest being pure white. After nourishing their young for a period of about three weeks, they are left to their own resources, and strange to say do not seem to take to the water very readily. About this time the females have lost the immense coat of fat they had before giving birth to their young, and take to the water to feed for a short while, when they again return to the ice, at intervals; but by the 20th of March they again make an appearance near the shore and feed voraciously, their chief food being capelin, or herring, but nothing comes amiss, sculpins, flounders, shrimps and other small fry, being swallowed indiscriminately. They do not all leave the ice at the same time, some remaining on it till the middle of April. They bring forth only one young at a birth, though in some rare instances, a few of which have come under my own observation, two are born (in one case I shot the mother containing twins). The males of this species fight very savagely amongst themselves, frequently leaving scars and marks from their teeth and claws.

"Their sense of smell is not very highly developed. I have frequently seen them come to the surface within five or six yards of,

and to the leeward of our boat, and so long as we did not move they did not pay the slightest attention to our proximity. On the slightest movement, however, they would disappear, but if not too shy, or previously shot at, would come up again a little farther off. When shy they do not reappear, except at a long distance, and frequently remain under water from fifteen to twenty minutes. When wounded with a rifle-ball or large buck-shot, unless nearly dead, they will go a great distance; but if struck by small shot, such as number A, they soon come to the surface. The only way in which I can account for this is, that the blood does not flow freely from the small shot-holes in the thick skin of the throat, but forming a clot on the inside, soon accumulates and chokes them; while with a ball or large buck-shot the wound is large and the blood escapes easily, thereby enabling them to breathe freely.

"Great herds of harps sometimes remain in this vicinity [Godbout] from March till June or even July, moving both up and down the river. They often work in towards the shore in the morning to feed on the shoals of herring and capelin, and go out again about seven or eight o'clock. When not pursued or disturbed by hunters this will be repeated day after day. During the months of July, August, September, October and November, they are usually not numerous, though, as before stated, a few are to be seen all the year round.

"I have been told by professional seal hunters that the females have young only every second year. I am inclined to doubt this statement, as it is only founded on the fact that some adult females are shot during the winter without young. I have often shot them myself, but do not consider it conclusive proof of this theory, as the same thing is observed amongst all mammals, though perhaps not quite to the same extent.

From a careful observation extending over several years, I have found that the proportion of males to females is about equal, that is, judging from the number killed annually at Point des Monts (about 250 on an average) where they are shot in the water. Of course when killed on the ice by the sealers in February and March the females predominate. This species and the common seal have only two teats and not four, as erroneously supposed by some."

At my request Mr. Comeau very kindly took the trouble to

visit Manicougan shoals during the present year. Concerning this trip he writes me:

"I took up my quarters on board the light ship there for three days in order to have a chance to see what kinds were likely to keep around the shoals. During that period I saw three large herds of the harp seal pass the light ship, moving east. The first herd, which I saw August 29, contained about five to six hundred *old* harps. The same day in the evening another smaller herd was seen, and on the 31st another herd of a couple of hundred. The captain, who is a very intelligent man and a sportsman, told me that it was nothing unusual but almost of daily occurrence, and that they did not seem to move more in one direction than another, but would sometimes go up one day and down the other."

Mr. Comeau further states that, "The harp is tolerably common as far up as the entrance of the Saguenay. A good many are killed every year, both in winter and summer, around Escoumain (twenty-five miles below the Saguenay). I have myself seen harp seals above Hare island. They were numerous this year (1884) off Godbout, in June and July."

To recapitulate: From the data in hand it appears that the harp seal is a permanent resident in the St. Lawrence; that it spends the summer wandering about, sometimes singly or in small schools, sometimes in large herds; that it ascends the river at least as far as the Saguenay, and is common between Mille Vasches and Manicougan; that it frequents with considerable regularity particular shores and estuaries to feed on the small fish that congregate there at certain states of the tide; that it works down the river in the early winter, and is particularly abundant about Point des Monts in December, January, and the early part of February; that it then passes farther down to whelp on the heavy ice in the gulf; that its young are born during the latter part of February or early March; that as soon as the young are able to shift for themselves the parents at once return, passing Point des Monts in great numbers on their way up the river.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

——Cannot the public press of the United States find something of interest in the scientific literature of the day to give their

readers? Although it is necessary that the leaders of the press should cater to the public taste in order to exist, it is not the less true that they are educators of the public, as they often remind us. That large part of the populace whose opportunities of school or college instruction have not been great, are undoubtedly educated in the affairs of the world by the newspaper press. The responsibility of editors and writers of this mass of daily literature is, therefore, great. It is necessary to portray the events of the stage on which men play their part, for more reasons than one. Without expatiating on this truth, which is denied by some, we refer to two beneficial effects of a general distribution of news. The publication of the good works of men stimulates imitation, and encourages the doers. The publication of the bad deeds of men brings on them that condemnation, which is their natural punishment, and which they naturally fear. It also brands the characters of evil-doers so as to practically protect society from them, more or less.

But does the daily press give a prominence to the good that men do, equal to that which they give to the evil? The most casual reading of our papers will convince any person that the purveyors to the public taste think that they must give the evil a great predominance. To what extent of space the columns of our newspapers are occupied with narrations of all forms of crimes, as compared with the space given to other subjects, everyone knows. When we consider the extent and number of the fields of useful human activity, and the number of persons engaged in them, the amount of space given to criminals in our newspapers is phenomenal. These people have a right to consider themselves, next to candidates for high office, the best advertised part of the community. If they do not become popular heroes and heroines, it is because the people are better than their educators of the press.

And this at a period when the greatest discoveries in science are being made with a rapidity never before known in human history. During the last twenty years truths have been brought to light which will revolutionize all but the most essential principles of the thought of the world, on which, as is believed by political economists, social organization and therefore governments depend. What newspaper ever announced the elaboration of the Gastræa theory of Haeckel; and the presentation of the cœlom theory of the Hertwigs? Who of them knows anything about the theory

of degeneracy of Dohrn and Balfour, or the hypothesis of the origin of the vertebrates of Semper? Which of them ever presented to its readers the solution of the problem of the origin of the existing Vertebrata and the descent of man by the American palæntologists?

Here our popular editor smiles incredulously. What do people know or want to know about Gastræas and cœloms and vertebrates? Well, we ask, what do people want to know about anything? The majority, not much, unless it is presented to them by somebody. But mankind only needs a little knowledge of these subjects in order to develop a strong interest in them. They are likely to do so on all grounds if they have an average amount of mental vitality. Why not? The sciences refer to everything they see, feel and handle, their own being in fact, in the most especial manner. The first thought of the primitive man is to explain the phenomena of nature, and it always will be part of the thought of people who are in any way in contact with nature. And these pursuits and thoughts are not only not harmless but useful. As much cannot be said of the constant absorption of histories of crime.

Gastræas and cœloms and zygosphens and corpora striata, are not more difficult to understand, either as to the thing or the name of it, than puts and calls and straddles; and they have this advantage, that they are always honest. Men brought up on a diet of the first-named articles, are, to say the least, more apt to be honest than those brought up on the last-named. Political news is necessary to every citizen, yet it is mixed with scandal; which although a necessary concomitant of human affairs, is not a wholesome article of mental food. Science contains no scandal, excepting as it reflects on those who violate its laws.

If "the proper study of mankind is man," the study of nature is proper, for nature has made man. The origin of man's body and of his mind are to be derived from the biological sciences; and this once learned, the way to create his future will certainly follow. If the nature of human society be in question, the science of anthropology is gradually explaining it.

But the newspaper press must have credit for what it is doing in these directions. It, however, rarely get beyond applied science; something that makes a material display naturally attracts the attention of the beginner. It is in pure science, however, that the greatest beauties can be found, and no fiction can present the interest which it has for those who give it even moderate attention.

—— The future of scientific research in Philadelphia is not hopeful. The school of biology of the University of Pennsylvania has been mainly placed in charge of men who are nearly or quite unknown in the field of original research, one of whom has publicly stated his doubts of its value! Another of the positions has been filled by a man who is only known as a worker in a widely different field. This arrangement we are told, is due to the fact that the services of these gentlemen are given gratuitously. The school of veterinary medicine has been put under direction of a veterinary physician who knows nothing of general comparative anatomy, so that a fine opportunity of fostering original research has been lost. The Academy of Natural Sciences has become a school for teaching instead of research. The only new enterprise in which it has recently engaged, has been the adoption of a new by-law, which is designed still further to diminish its usefulness.

Both the leading societies of the city allow the occupation of the hours of their regular meetings by amateur disquisitions on the rudiments of science, such as are well adapted for popular lectures, but are totally out of place in such institutions. All this may be traced to the imbecility and selfishness of a few of the leading workers in that city.

——:o:——

RECENT LITERATURE.

KRAEPELIN'S PROBOSCIS OF MUSCA.[1]—Kraepelin's paper gives the most complete account extant of the structure of an organ which has excited interest since the time of Aristotle. His investigations were chiefly on the proboscis of the Blow fly (*M. vomitoria*), and exclusively on its adult anatomy. The embryology of these parts has not been attempted by Kraepelin, baffled Weismann, and remains yet to be worked out. The following is an abstract of Kraepelin's paper, with pen-and-ink copies of the more important of his thirty-eight fine illustrations. I venture to add some criticisms in the form of foot-notes.

GEORGE MACLOSKIE.

PRINCETON, April 12, 1884.

I. CHITINOUS PARTS AND PRELIMINARY ORIENTATION.—The Muscidæ have nothing corresponding to the mandibles of other insects, and the first maxillæ are in a rudimentary condition; the second (or labial) maxillæ are well developed, coalescing and forming the chief part of the proboscis. There are also two unpaired pieces termed the labrum (oberlippe) and hypopharynx (Fig. 1, *o* and *h*). These lie imbedded in a furrowed channel (Fig. 2, *fp*) on the upper side of the cylindrical labium. The whole structure starts from the summit of a beak-like soft-

[1] Zur Anatomie u. Physiologie des Rüssells von Musca, von Karl Kraepelin, Hamburg. Zeit. f. wis. Zool., Bd. XXXIX, 1883, pp. 683–720, mit Tafel XL u. XLI.

skinned extension of the head. This conical head-part (Fig. 1, *bp*) being retrusible into the firm head-capsule (cranium, *c*) was

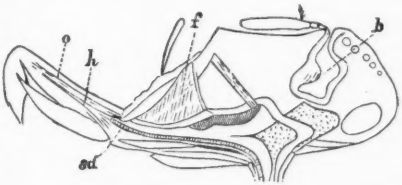


Fig 1.—Head of blow fly, all the figures enlarged.

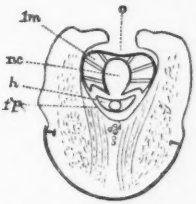


Fig. 2.—Section of Proboscis of the blow fly.

supposed to be the coalescing mouth-parts till Macloskie and Dimmock explained its true nature.[1] I shall call this soft head-part the "head-cone" (the basi-proboscis). The totality of the subsequent parts, including labium, labrum and hypopharynx (the medi-proboscis and disti-proboscis) I call proboscis in the strict sense.[2] (The so-called *epipharynx* has no existence.)

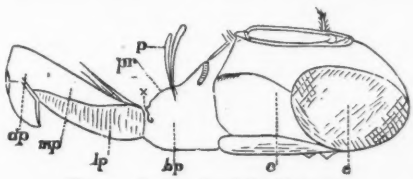


Fig. 3.—Proboscis of the blow fly.

Head-part of Proboscis (basi-proboscis, Fig. 1, *bp*).—The thin-walled basi-proboscis bears a pair of unsegmented palps (*p*) on its upper side, each resting on two chitin-ridges, one of which (*pr*) runs forward to the insertion of medi-proboscis, where it unites with a long rigid chitin-bar (one on each side, the *maxillary tendons*, Fig. 4, *mt*) which runs backward, free under the thin covering-membrane of the basi-proboscis. These bars are the rudimentary first maxillæ, whose palp-bearing part (*pr*) extends backwards coalescing with the roof of the basi-proboscis, and the belt-like pieces under the wall are in connection with the other trophi (especially the labrum) and frequently (in Mesembrina, Aricia,

[1] Macloskie in AMERICAN NATURALIST, 1880, p. 153, read before the N. J. Microscopical Society, Nov. 18, 1879, and N. Y. Academy of Sciences, Dec. 1, 1879. Dimmock's Inaugural Dissertation on the anatomy of the mouth-parts and sucking apparatus of some Diptera. Boston, 1881.

[2] The terms in parenthesis (basi, medi and disti-proboscis) were proposed by me in the article quoted, and are here retained as convenient renderings of the author's terms (kopf-kegel, eigentlicher Rüssel, labella). I do not think it wise to confine the term "proboscis" to the mid and distal parts, as that term is *functional*, indicating the entire mechanism for protrusion, however we may explain the homologies of its parts.—*G. M.*

&c.) bear a small piece (lade) which proves them to be basal parts of the first maxillæ.[1]

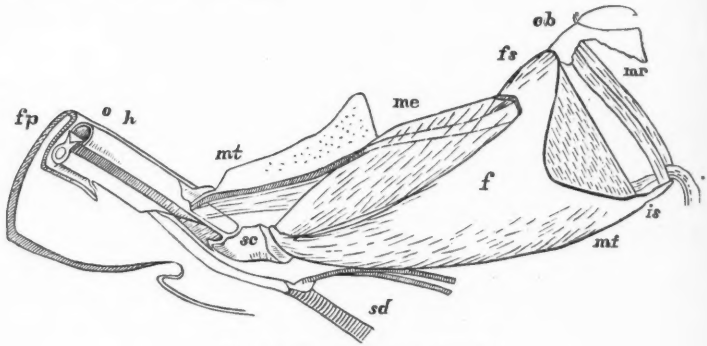


Fig. 4.—Proboscis of the blow fly.

Seen from above, the basi-proboscis shows a strong chitinous horseshoe-shaped thickening, with the open sinus forwards, lying below the soft skin of the basi-proboscis. This is the upper surface of a complex strong structure lying inside the basi-proboscis and variously termed fulcrum, œsophageal sac, pharynx, &c. (Fig. 1, *f*). It is present in all Diptera and Hemiptera, and has been shewn by Menzbier, Macloskie and Dimmock to have nothing to do, morphologically speaking, with the trophi or proper mouth-parts, but is a thickening of the œsophagus-walls, which in Muscidæ send stout processes to the roof of the basi-proboscis and so secure a firm connection with the roof of the cranium.[2]

The general form of the fulcrum reminds one of a Spanish stirrup which is suspended by its supero-posterior processes (Fig.

[1] These chitin-bars (Fig. 4, *mt*) were shewn by me to be the *great tendons* of some of the trophi (*loc. cit.*). They are probably the tendons of the first maxillæ, and being large and rigid suggest that as a whole these maxillæ, though not much hardened, are otherwise well developed, a view which is reinforced by the presence of the palps. I shall here use "maxillary tendons" as the rendering of Kraepelin's "spangen der unterkiefer."—*G. M.*

[2] Menzbier, uber das Kopfskelett, &c., der Zweiflügler, Moscow (1880); Macloskie (*loc. cit.*, 1879); Dimmock (*op. cit.*, 1881). I gave the view that the fulcrum represents the endocranium of other insects. My friend Dimmock cautiously declined to say yes or no to this theory, and Kraepelin, without noticing what I have written on this head, here enunciates the view that it is a thickening of the wall of the œsophagus, a view which I venture to say was shewn by me to be untenable. An œsophageal chitinization must always be towards the lumen of the œsophagus, whereas Kraepelin shews that the fulcrum surrounds the œsophagus. I have compared the fulcrum of Diptera with the structures referred to in such Diptera as the mosquito, and in Hemiptera, and have not been able to decide whether they correspond; as a whole I think the probabilities are against their being homologous. Subsequent consideration, especially with reference to what has been done as to the embryology of the Diptera, has strengthened my faith in the endocranial theory.—*G. M.*

4, *fs*) to a band in the anterior margin of the cranium (*cb*). Its side-walls are strong chitin-plates, with a sinus looking backwards. The sole of the "stirrup" is double, of two chitin-plates superposed, and having a cavity between them, within which the œsophagus passes forwards (Fig. 5, *of*, *uf*). The infero-posterior extremities of the "stirrup" are prolonged into horns, one at each side (Fig. 4, *is*), which are connected by retractor-muscles (*mr*) to the cranial band (*cb*). The maxillary tendons are at their proximal extremities connected by a short muscle with the supero-posterior extremity of the fulcrum, and by a long muscle (*me*) with its anterior horn. Below the floor of the fulcrum are seen muscles running forwards, and also the trachea-like salivary duct (Fig. 5 *sd*).

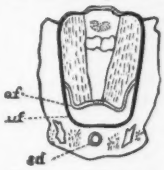


Fig. 5.—Fulcrum.

The Proper Proboscis (medi-and disti-proboscis, Fig. 3, *mp* and *dp*).—When viewed from the side, this part (representing the labium) is a cylinder, anteriorly divided into a two-lobed tip, the labellæ. Viewed from above we see that it has a superior longitudinal canal in which two unpaired chitinous stylets are embedded (Figs. 1, 4, 2, *o* and *h*). The upper one of these two stylets, the labrum (oberlippe, *o*) appears as the direct continuation forwards of the upper anterior margin of the basi-proboscis, and, like all insect appendages, is hollow, enclosing muscles, tracheæ and nerves. As the labium has a deep groove on its upper surface (Fig. 2, *up*), so the labrum has a similar groove on its under surface (*o*), and is in fact an inverted semi-cylinder with double walls. (Its lower wall was once deemed a distinct piece, epipharynx.)

The under proximal extremity is articulated to a small chitin-capsule, described by Macloskie and Becker as a triangular "binding-piece," and overlooked by other observers (Fig. 4, *sc*). This "small capsule" lies directly in front of the fulcrum, whose form it repeats in miniature. The floor of the small capsule is continuous with the under floor of the fulcrum, and the upper plate of the fulcrum-floor partially roofs the small capsule. The side-walls of the small capsule bulge out and are chitinized, giving a basis for the insertion of the under parts of the labrum, whilst the floor of the small capsule supports the second stylet, or hypopharynx.

Hypopharynx.—This, like the labrum, is a hollow cylinder with a longitudinal furrow on its upper surface (Fig. 2, *h*). Its groove meets that of the under side of the labrum, so as to complete a nutritive tube (*nc*) which opens on the distal end of the proboscis, and forms the beginning, or rather the antechamber, of the alimentary canal. Imbibed fluid penetrates this canal, then enters the "small capsule," which serves as a reservoir, passing next into the space between the double floor of the fulcrum, and so on

to the proper œsophagus. The inner cavity of the hypopharynx is, through its whole length, pierced by the salivary duct (*sd*) coming forwards from thoracic salivary glands, advancing below the floor of the fulcrum (Figs. 4, 5, *sd*), and entering the hypopharynx (not piercing it as Meinert supposed) and opening at its distal extremity. I place the proper mouth-opening at the anterior end of the "small capsule," where the labrum and hypopharynx are inserted. The labium, by its grooved upper surface, serves as a case for enclosing the stylets, as with Hemiptera. All the proboscis-parts are bound together by the thin membranous wall of the labium.

Labium (unter lippe).—This is a cylindrical evagination of the basi-proboscis, but furrowed above. Thus it serves as a bed for the nutritive canal. It is divided in front by a median slit into two motile cushions, the labellæ, which Burmeister and Erichson shewed to be the metamorphosed labial palps. The internal cavity is occupied by muscles, nerves, tracheæ and glands. Its under part is much swollen, and is strongly chitinized, the thickening extending up the sides (Fig. 3, *lp*). This under part (infe-

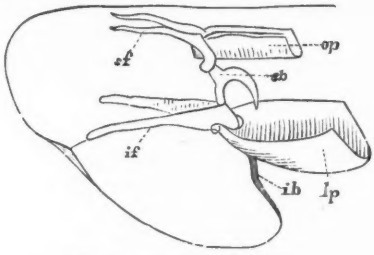


Fig. 6.—Side view of labium.

rior labial plate) supports, at its distal extremity, two short, horn-like processes which bear a stout triangular piece. On this piece is inserted a stout chitin-fork (Fig. 6, *if*) whose long legs advance forwards. The fork sends downwards a strong unpaired arcuate band (*ib*). This chitin-fork is joined to the labial plate not merely at its articulation, but also by a folding membrane which unites them along their length.[1] Free vertical motion is thus allowed to the forking parts, but the extent downwards of its excursions is limited by the thin membrane.

The upper plate (the "furrow-plate," Figs. 4, 2, *fp*) of the labial cylinder forms the bed of the channel which contains the labrum and hypopharynx. The front end of this plate is thickened and bears a strong chitin-fork (the superior fork, Fig. 6, *sf*), repeating in some measure the parts of the inferior fork, the two branches running parallel forwards, and united and limited by

[1] A similar connection by means of membrane is described by me in the maxillary suspensorium of the bee. AMERICAN NATURALIST, 1881, p. 357.—*G. M.*

membrane which connects them with the rim of the furrow-plate. From below this fork an unpaired piece (*sb*) connects it with the inferior fork, and sends backwards a hook-like process.

The thin membrane, which is continuous with the margins of the labial plate, enlarges distally and swells out so as to constitute the two large terminal labellar cushions of the disti-proboscis. In the resting condition these lie with two flat surfaces adjoining, and they have each an inner and an outer surface. The limbs of the lower forks support the outer cushion-walls. The upper forks, whose limbs run parallel, support the inner surface of the cushions. Between these supporting bars the thin membrane is sculptured in a special way. Each branch of the superior fork has, from its place of articulation with the furrow-plate, a chitin-arc running longitudinally (Fig. 7, *ca*); between

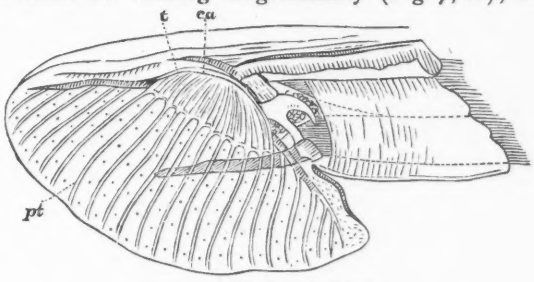


Fig. 7.—Side view of labium.

these arcs the membrane is extended.[1] The membrane has radial folds in bas-relief, soon rising to high relief, forms which depend on secondary foldings of the membrane, called by Macloskie and Dimmock "scraping teeth" or spines (Fig. 7, *t*). There are three rows of such spines, the second and third rows being foldings external to those of the order next below. These are succeeded by foldings of a fourth order which, instead of forming teeth, bend round as semicircular bars and form the beginnings of the often described pseudo-tracheæ (*pt*). The supporting arches thus have (morphologically) the same origin as the teeth. On the outer rim, where outer and inner walls merge, the pseudo-tracheæ, after diminishing distally, terminate. There are also straight supporting rods between the pseudo-tracheæ (Fig. 8, *sr*).[2]

[1] In the housefly there are only one, or occasionally two rows of teeth.—*G. M.*

[2] These supporting rods are not in the Housefly. I may add to the above that the projecting margins of the pseudo tracheæ are crenulate with deep sinus between the adjoining crenellæ. The supporting arcs are forked alternately at opposite extremities (AMER. NAT., 1880, p. 153, Fig. 1, *C*), and each crenella is supported medially by the simple extremity of one arc, and at its two margins by the semi-forks of adjoining arcs; so that the deep sinus between crenellæ is bounded by the forked end of an arc. The fine membrane between the pseudo-tracheæ is hexagonally areolate, like the facets of the eyes, the areoles having sunken boundaries (which may flatten out when the labellæ are expanded). My observations are from the *housefly*.—*G. M.*

II. Musculature and Motile Mechanism.—1. *Movements of the basal parts of the Proboscis.*—There are two pairs of retractor muscles. One pair arise from the anterior band of the cranium (Fig. 4, *mr*) and are inserted on the inferior suspensor processes (*is*) of the fulcrum. The other pair arise from the postero-basal plate of the cranium and reach forward so as to be inserted on a cross-ridge (Fig. 3, *x*) near the end of the basi-proboscis. By their contraction they retract the thick wall-plate of the labium telescopically into the basi-proboscis. The second pair also flex the hypopharynx on the "small capsule," and the whole labium upon the fulcrum; we may term them "flexors of the labium."

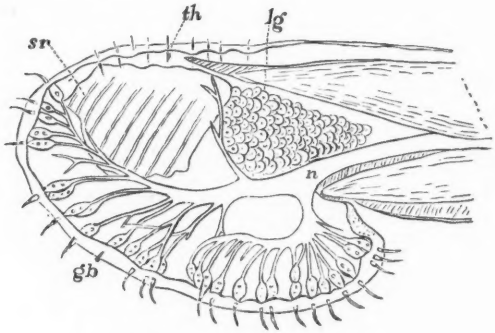


Fig. 8.—Nerves, etc., of labium.

Two pairs of weak muscles arise from the sides of the occipital foramen. One pair of these aid the unfolding of the basi-proboscis. The other run forward over the "small capsule" and seem to be inserted in the base of the labrum; they may be retractors of the labrum.

The *mode of protruding* the proboscis involves a more difficult problem. The muscle which Becker describes as drawing the fulcrum around its hinge, has no existence. The tracheal apparatus comes to exercise a powerful influence at this point. The large air-trunks after entering the head by the occipital foramen enlarge to form (seemingly two) capacious air-sacs, which, when the proboscis is extended, fill all the cranial cavity except what is occupied by the nerves and the invaginated "cranial bladder" (Fig. 1, *b*). This cranial cavity is serviceable for the retraction of the proboscis, as by the collapse of the tracheal sacs through the withdrawal of air from the head, a vacant space is left for the reception of the fulcrum. (I renounce the view once held by me that the cranial bladder aids in retracting the proboscis.) The inspiratory mechanism of the trunk by driving air towards the head causes the protrusion of the basal parts of the proboscis. The

view that the proboscis was protruded by air-pressure was long ago enunciated by Gleichen, and has been recently established by Macloskie and Dimmock by experiments made under water. I have found traces of a muscle in the head by whose action such inspiration may be assisted.

Simultaneously with the extension and swelling of the basi-proboscis, the extension of the medi-proboscis takes place. This is provided for by the articulation of the hypopharynx and labrum on the "small capsule." The long maxillary tendons (Fig. 4, *mt*) are firmly united to the chitin-wall of the labrum. From the proximal terminal knob of these tendons a strong muscle proceeds to the front horn of the fulcrum (Fig. 4, *me*). Another short muscle binds the same knob to the superior wall of the basi-proboscis. The larger pair of these muscles are extensors of the medi-proboscis.[1]

2. *Movements of the Labellæ* (disti-proboscis).—The bifurcating framework already described permits much change of the labellæ. Muscles coming from the rigid inferior plate of the labium reach the branches of the forks, and control their movements. The muscles by contracting open and spread out the labellar cushions. As the muscles become relaxed the elasticity of the bars and fork-limbs suffices to bring the whole back to its position of rest. There are no antagonizing muscles to the fork-retractors. After death these retractors act so excessively as to turn the cushion-like labellar faces outwards.

As to the swelling of the labellar cushions, Macloskie and Dimmock represent the tracheal air as the means of swelling. But careful sections shew that the tracheæ do not enter the label lar cushions, and there are no bladder-enlargements as must be present for such an office. All the parts of the labellæ not occupied by organs are filled with blood whose pale corpuscles can be seen. Hence it is clear that the swelling of the labellæ is caused by inflowing blood, as Becker supposed.[2]

[1] I have found that these muscles by alternately contracting on each side of the proboscis move its tip from side to side. The connection of the maxillary tendons with the labrum and hypopharynx is so pliable (at least in the housefly) that I question the extensor function here assigned to its muscle.—*G. M.*

[2] On this subject I must join issue with the distinguished author. The presence of blood in the lamellæ does not disprove their being distended mainly by air, if independent evidence to this effect be forthcoming; and the finer tracheal branches and sacs, not being chitinized, are not readily recognized, and may be represented by what are described below as glands. Kraepelin's figures shew that he has not sufficiently examined these structures in living specimens, for they all represent the disti-proboscis in a collapsed condition; and no reference is made to the fact that when the proboscis is distended there is always a large swelling in the inferior angle between the medi-and disti-proboscis. On cutting or pricking this swelling under water, one or two air-bubbles escape, and the labellar cushions as well as the more proximal parts instantly collapse. Nor can they be again protruded. Of course the fine air-reservoirs, when under dissection, are in the collapsed condition, and easily elude observation; but they may be seen to swell as by peristaltic movements in living specimens.—*G. M.*

3. *The Suctorial Mechanism.*—The suctorial canal begins where the paired limbs of the upper labellar fork are fixed on the extremity of the upper labial plate. The entrance is guarded by bristles to prevent the escape of fluid. Behind this are seen the tips of the labrum and hypopharynx, between which the entering fluid penetrates so as to reach the proper œsophagus.

The labrum having radial muscles between its two plates (Fig. 2, *lm*) can enlarge its lumen and so effect suction. At the triangular "small capsule" the action of the fulcrum comes into play, its muscles raising the upper floor-plate (Fig. 5, *of*), and so enlarging the cavity below and continuing the suctorial process. Thus the fluids are absorbed and forced towards the stomach.

For dissolving solid substances the secretion of the glands is provided. There are three pairs of salivary glands. The chief ones are in the thorax, with the long salivary duct resembling a large trachea (Figs. 1, 4, 5, *sd*). A second pair is in the distiproboscis (Fig. 8, *lg*), large-celled round masses with a common duct opening near the tip of the upper labial plate. A third collection of salivary glands is at the passage of the fulcrum into the œsophagus.

The salivary secretion is spread over the labellar cushions by means of the pseudo-tracheæ.[1] Sugar, bread-crumbs, &c., being porous absorb the fluid; it is not the sugar that is absorbed by the saliva, but the saliva by the sugar.

III. Hairs and Sense-Organs.—The proboscis is covered with short hairs not supplied with nerves. Besides these there are three kinds of special hairs:

(1) The *tactile* hairs are on the upper rim of the labellar cushions (Figs. 8, 9, *th*), hollow, having a nerve with a ganglion (*tg*) below.

(2) Labial glands with bristles are on the outer margin of the labellæ (Figs. 8, 12, *gb*). Each of these bristles is supplied with a duct leading from a many-celled mass, and is grooved at one side as if for conveying a secretion outwards (Künckel and Gazagnaire deem these to be sense-organs with nerve-ganglia).

(3) There are also taste-organs over the surface of the labellæ, between the pseudo-tracheæ (Fig. 7, indicated by dots, and Figs. 10, 11). Each hair has a chitinous basal ring; its nerve is gangliated, and is perforated by an axis cylinder which reaches the surface, indicating that here we have to do with a genuine organ of special sense.

[1] An easy experiment illustrates this. Press out the proboscis, and before the labellæ swell, their surface is covered with saliva like a drop of dew. Further pressure swells the labellæ, and instantly the saliva disappears, being drawn into the now expanded pseudo-tracheæ by capillary action.—*G. M.*

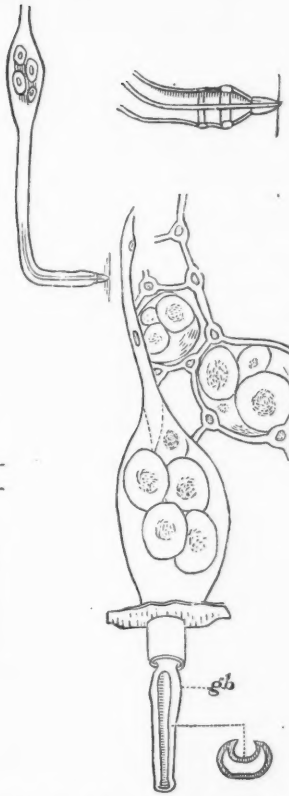


Fig. 10.

Fig. 11.

Fig. 9.

Fig. 12.

EXPLANATIONS OF THE FIGURES.

FIG. 1.—Median section of Fig. 1.
FIG. 2.—Transverse section of medi-proboscis.
FIG. 3.—Head of *Musca vomitoria*, with extended proboscis. Side view (left).
FIG. 4.—Basi-proboscis with part of medi-proboscis, with the covering membrane removed (including part of Kraepelin's Fig. 3).
FIG. 5.—Transverse sections of basi-proboscis and fulcrum.
FIG. 6.—Supporting parts of disti-proboscis.
FIG. 7.—Disti-proboscis, with pseudo-tracheæ.
FIG. 8.—Longitudinal section of disti-proboscis.
FIG. 9.—Tactile hair.
FIGS. 10, 11.—Taste organs.
FIG. 12.—Dermal glands with gland-bristle and its cross-section.

REFERENCE LETTERS.

(For all the figures.)

b, Crainal bladder.
bp, Basi-proboscis.
c, Cranium.
ca, Chitin-arch supporting pseudo-tracheæ.
cb, Band on front of cranium.
dp, Disti-proboscis.
e, Eye.
f, Fulcrum.

fp, Furrow-plate.
fs, Suspensory process of fulcrum.
gb, Gland-bristles.
h, Hypopharynx.
ib, Inferior labellar band.
if, Inferior labellar fork.
lg, Labellar glands.
lm, Muscles of labrum.
lp, Inferior labial plate.
me, Extensor muscles.
mp, Medi-proboscis.
mr, Retractor muscles.
mf, Muscle of fulcrum.
mt, Maxillary tendon.
n, Nerve.
nc, Nutritive canal.
o, Maxilla (oberlippe).
of, Upper plate of floor of fulcrum.
op, Upper labial plate.
pr, Palp-bearing ridge.
ps, Pseudo-tracheæ.
sb, Superior labellar band.
sc, Small capsule.
sd, Salivary duct.
sf, Superior fork.
sr, Supporting rods.
t, Teeth.
tg, Tactile ganglion.
th, Tactile hairs.
up, Under plate of floor of fulcrum.
x, Cross-ridge near top of basi-proboscis.

OBER'S TRAVELS IN MEXICO.[1]—In point of interest to the public and as a contribution to popular geography this book should meet with favor. To the naturalist desirous of learning something of the physical features of the vast country here described, and of its more prominent biological and ethnological characteristics, Mr. Ober has done a favor.

The work is divided into three books, devoted to Yucatan,

Aboriginals of Mexico.

Central and Southern Mexico, and the border States next to the United States, so it will be seen that the author covers a large extent of ground, indeed, the number of miles traveled (nearly a

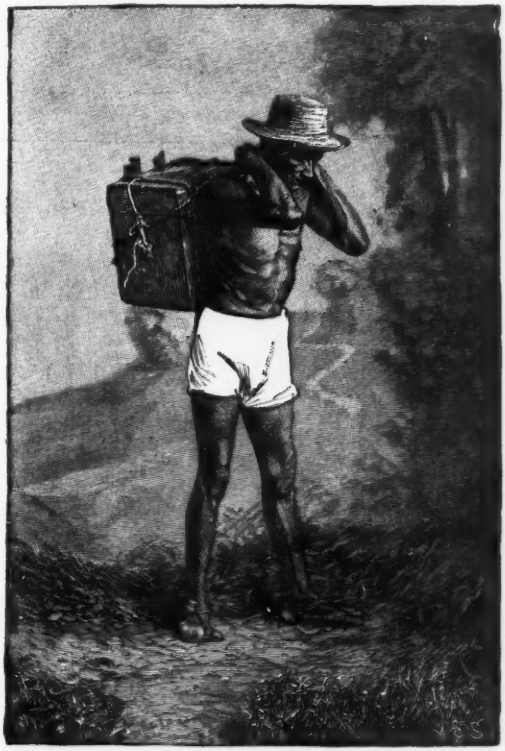
[1] *Travels in Mexico and Life among the Mexicans.* By FREDERICK A. OBER. With 190 illustrations. Boston, Estes & Lauriat. 8vo, pp. 672.

Donkey Boys of Guaymas, Gulf of California.

thousand on horseback) exceeded 10,000, and although he usually went over the routes traveled by the diligence, steamer or railroad, Mr. Ober kept his eyes open and records his experience in a graphic, pleasing way, and the illustrations, which are passably good, add to the attractiveness of the narrative.

On his way to Uxmal, which is briefly described and well illustrated, Mr. Ober visited the water caves of Yucatan, which he thus describes:

"An hour after leaving this hacienda we reached that of



Indian Carrier, Yucatan.

Mucuyché, famous for its *cenote*, or water-cave. There are no rivers in Yucatan that flow above ground, and the people are wholly dependent upon the clouds for their supply of water, and upon the rivers that run beneath the surface. The whole province is one vast table of coral rock, beneath which flow large streams and even rivers. These break out at intervals into caves and caverns formed by earthquakes and the pressure of the water,

though sometimes the supply is due to the infiltration of surface water into natural grottoes in the coral rock. The Indians, centuries ago, marked the courses of these subterranean streams by heaps of stones, and their cities were always built near or about the water-caves, as is now shown by their ruins. These caves, where the rivers appear to the light of day, are called *cenotes*. There are many in Yucatan, and in Merida are several, utilized as bathing places—most refreshing resorts in the heat of day. The

Indian Boy, Yucatan.

cenote at Mucuyché is a cavern, perhaps forty feet deep, broken down at one side, forming an arch of limestone with every shape of stalagmite and stalactite, the roof full of holes in which were the nests of hundreds of swallows and hornets. A flight of stone steps leads from the delightful garden above, and some avocado pears and cocoa palms growing at the bottom thrust their crowns above the general level of the ground. The water is clear and very deep

at the east end of the cave, with many fish in it—'cenote fish'—which are said to be blind, like those in the Mammoth cave. Roots of trees hang pendant in clusters, behind which lizards and iguanas dart along the ledges; swallows circle in dense masses about the arch, forming a complete ring, and making a deafening, whirring noise with their wings."

Another chapter is devoted to Mayapan and the Mayas, the author indulging in severe but well merited criticism of the methods of M. Charnay and of Dr. L. Plongeon, and for their hasty conclusions, based on preconceived notions, as to the age and builders of the ruined cities they have so zealously explored.

We are then treated to accounts of the logwood forests and to scraps of the natural history of the north coast of Yucatan. Palenque was not visited by the author, though a chapter is devoted to this engrossing topic.

In the account of Mexico the chapter on Popocatapetl and the account of the ride from Vera Cruz to Mexico brings out clearly the nature of the better known Mexican volcanoes and of the three regions passed over in going from Vera Cruz to the City of Mexico. In Southern Mexico the palaces of Mitla, among which Mr. Ober spent a few days, are briefly described.

Though written to please the tastes of the public, we may be sure that the narrative is reliable, the information authentic, and that this book is, all in all, the best hand-book of Mexico the intending visitor to that interesting country can take along with him.

BRIEFER COURSE IN BOTANY.[1]—We have examined this little volume with more than usual care. Two things command attention at once: First, that it is written by a teacher of experience; and second, that its author is both an acute observer and a thoroughly posted compiler. It is, in its text, a fresh book, that is, the presentation of the subject matter is done in such style as indicates that the author had thoroughly considered both the language and order of presentation of the facts.

The appearance of this book is most opportune. Botany, in this country, has largely passed through the preliminary period of *systematic work exclusively*. The great masters have arranged our vegetable hosts into an order which will, without serious change, stand for the next twenty years or more. And the growing need, as well as the growing desire, is to know more of the origin, structure and evolutionary tendencies of the individual plant. Good, cheap microscopes can now be had which make such studies possible. The Briefer Course in Botany, then, is just the book required to foster the existing disposition. There is nothing superficial in it, nothing needless introduced, nothing

[1] *American Science Series. Briefer Course in Botany.* By CHARLES E. BESSEY, M.Sc., Ph.D., professor of botany in Iowa Agricultural College. pp. 292. Published by Henry Holt & Co.

essential left out. The language is lucid; and as the crowning merit of the book, the author has introduced throughout the volume "*practical studies*" which direct the student in his efforts to see for himself all that the text teaches. It is hardly possible to estimate too highly the value of these "*studies*" as an educational force.

On the first page of the brief *Preface* the author gives his reasons for introduction of the terms Zygophyta, Oöphyta and Carpophyta. It is enough to say that to any one these reasons should be satisfactory. To the teachers who know the confusion caused in the minds of pupils by the older nomenclature, this change will probably be thoroughly welcome. It is an oversight that instead of asexual the author did not use the term nonsexual, for besides being contrary to best usage, asexual, by slight typographical blunder, is often made to read a sexual, just what is not intended. Hence asexual should not be used or perpetuated.

As indicating the scope of this little book we give the chapter headings:

I. Protoplasm and Plant-cells.
II. The Tissues of Plants.
III. The Groups of Tissues, or Tissue Systems.
IV. The Plant Body.
V. The Chemistry and Physics of Plants.
VI. Classification and Distribution of Plants.

A glance shows that the student is here plainly led from the natural foundation on simple facts up to the latest views and broadest generalizations.

We have but a single criticism to make. One more chapter is needed, which should briefly explain the terms used in analysis of plants.

There is a danger that we may run from one extreme to another in our teaching, and in our new love for morphological botany, neglect systematic botany too much. A part never can be greater than the whole, and we regret the tendency, already too marked, of being content to study cells and cell growth and aggregation, without being able to name the plant on which the observations are made. No one is better qualified than Professor Bessey to add this needed chapter. Another edition is sure to be called for soon, and when it appears we hope to find this one chapter added to what is already a most important and admirable work.—*J. T. Rothrock.*

THE PEOPLE'S CYCLOPEDIA.[1]—This work, in three royal octavo volumes, contains a great deal of information in a condensed form. What it may be in other directions we do not know, but we cannot speak highly of its scientific value. But two well-

[1] Phillips and Hunt, New York. Edited by W. H. DePuy, LL.D., 1883.

known scientists appear as editors, Professor C. F. H. Peters and Professor Alex. Winchell, and their influence has not been largely felt. To give an idea of its standing, we quote two points. Of the Dinosauria it says "the principal genera are Megalosaurus, Iguanodon and Hylæosaurus!" This information, now a quarter of a century old, indicates that the editors have not heard of the many American genera of this order. Of the doctrine of development it says (p. 533): "As a hypothesis the theory has great plausibility, but lacks the support of one accredited instance of the organization of species by natural selection." The list of scientific men at the end of the last volume is absurdly defective. Johnson's encyclopedia gives much fuller information on American subjects.

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——The bearing of some recent determinations on the correlation of the Eastern and Western terminal moraines. From the author.

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——Contributions to the history of the Commander islands.

——Fra det Yderste Osten, III, IV. All from the author.

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Silliman, B.—Sketch of the life and scientific work of Dr. J. Lawrence Smith. 1884. From the author.

Grimes, J. S.—Mysteries of the head and the heart. Chicago, 1881.

——Problems of creation. 1881. Both from the author.

Ballard, H. H.—Hand-book of the St. Nicholas Agassiz Association. 1884. From the author.

Shufeldt, R. W.—The debt of science to the late Surgeon-General Chas. H. Crane, U. S. Army. N. Y. Medical Journal, Sep. 13, 1884. From the author.

Frazer, P.—The Peach Bottom slates of the Lower Susquehanna. 1884. From the author.

Shelton, E. M.—Report of the professor of agriculture, Kansas State Agricultural College, 1883. From the author.

Potts, E.—Some modifications observed in the form of sponge spicules. On a supposed new species of Cristatella. Rep. Proc. Ac. Nat. Sci., 1884. From the author.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA.—*Mr. Graham's Ascents of Himalayan Peaks.*—In the August number of the Proceedings of the Royal Geographical Society Mr. W. W. Graham gives an account of his travels in the Himalayas. He reports that Kanchinjinga is inaccessible, but believes that the circuit of the great peak could be made in nine days, although one pass of 20,000 feet would have to be crossed. The peaks are set with rocky aiguilles impossible of ascent, for beside them the Matterhorn is a mere dwarf. In an attempt to ascend Danagiri (23,186 feet G. T. S.) Mr. Graham and his companion reached 22,700 feet, and saw below them Mount Monal (22,516) and A_{22} (21,001), but were compelled to return by a hail storm. In one place they found the map of the topographical survey highly inaccurate, "one whole range omitted, glaciers portrayed where trees of four feet thickness are growing, and the hill shading generally entirely imaginary." Peak A_{21} (Mount Monal) was successfully attempted, but A_{22} was found to terminate upwards in an inaccessible precipice. Jabonu (21,300–21,400 feet G. T. S.) was also ascended, and on another occasion Mr. Graham and two companions reached to within about 40 feet of the summit of Mount Kabru (23,700 feet). North-west of this peak, less than seventy miles, lay Mount Everest, said to be the highest mountain in the world, but, in the judgment of Mr. Graham and of his skilled Swiss guide, Emil Boss, surpassed by two unknown peaks, one rock and one snow. The travelers agree that the Himalayan glaciers lie at a greater angle than the Swiss, and that the general slope of the peaks is greater. None of the inconveniences usually described as experienced by travelers who ascend to great heights were felt, but the pace of the heart increased greatly, and its beatings became audible. Mr. Graham thinks it possible that the headache, nausea, bleeding, etc., suffered by some, arise from a weak heart. At 22,000 feet,

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

upon the slopes of Mount Kabru, a pair of snow-white hawks were seen flying as easily as at lower levels. The ascent of Kabru is the highest yet accomplished by man. In the discussion which followed the reading of Mr. Graham's paper, it was elicited that the two unnamed peaks near Mount Everest had been seen before by native surveyors.

ASIATIC NOTES.—There is no satisfactory evidence, according to Professor R. Lenz, that the Oxus flowed into the Caspian before the thirteenth century, as the Arabian geographers of the ninth century, who have been quoted in proof of this connection, appear to have confounded the Caspian with the Aral. It is known that the river had two branches in the thirteenth and fourteenth centuries, but the branch emptying into the Caspian probably ceased flowing in the sixteenth century. This agrees with Turcoman traditions. In 1850 and 1869, during great floods, the waters of the Amu Darya penetrated into Lake Sara Kamysh. The level of the Caspian is slowly but steadily falling, and the fresh-water seals are fast diminishing in number.——A recent issue of Petermann's Mittheilungen contains a map showing the route pursued by A. Regels in his journey through Darwas in the last months of 1883. The Chingan, a tributary of the Oxus, was followed almost to its source in the Garma glacier.——Mr. Holt Hallett has returned to Bangkok after a successful expedition to the Shan States, during which he has surveyed over 1500 miles of route, determined the position of the Shan ranges, and made vocabularies of the aboriginal races and notes on the histories of the several States.——The French traveler, M. Cotteau, who has recently visited Sarawak (Borneo) says of that colony: "It is a curious phenomenon to see a population of 300,000 Dyaks, Malays and Chinese governed by thirty Europeans economically, almost without written laws, without an army, and without police."——M. Lessar has explored the middle portion of the country watered by the Murghab, a part never before traversed by Europeans.——A recent number of Petermann's Mittheilungen contains a map of Merv and of the Russo-Persian boundaries in the vicinity, with the routes of the Russian engineer, P. M. Lessar. Between Askabad and Sarakhs the distance is 280 versts, and the route lies along the "Alek" or foot of the mountains which form the boundary between the two countries. A few miles north of Sarakhs the boundary attains the river Herirud, which here flows toward the south, and divides Persia from Russia until the Borchut range, a continuation of the Paropamissus, is reached. These mountains form the northern boundary of Afghanistan, and the Russian frontier reaches to within twenty-five miles of Herat. Merv was formerly erroneously supposed to be 1900 feet above the sea, but is really only 800.

AFRICAN NOTES.—M. Dutreuil de Rhins has communicated to the Geographical Society of Paris notes from De Brazza, by which it appears that the land route between Franceville and the Alima has been shortened from seventy-five miles to fifteen or twenty through the discovery of an affluent of the Ogowé. On his last visit to the Makoko M. de Brazza was accompanied only by a man and a boy. The French Mission at Cape Lopez now has fifty huts, and proves to be salubrious.——Mr. H. H. Johnston writes to the Royal Geographical Society from Ururа on the mountain Kilimanjaro. He speaks of it as "one of the loveliest sites in the world. Above me towers into the deep blue heaven the snowy head of Kibo', around me are green hills and forest-clad ravines in whose profound depths great cascades of water leap from rock to rock and splash the fronds of luxuriant ferns; before me lies spread out a vast blue plain—'all the world,' as my host, the chief Mandara, proudly says—and my view southward is only bounded by the distant horizon."——Clemens and Gustav Dehardt have recently explored the Tana river and its two mouths. Massa, the farthest point attained, is found to be in 39° 47′ E. long. instead of in 38° 20′, thus the river runs in a more southerly direction than has been supposed.——Capt. Brandon Kirby, probably the first white man who has penetrated the country due north of Coomassie, and reached the southern limits of those inland nations who have hitherto been prevented from communication with the seaboard by the formerly impassible barrier of Ashanti power, does not think that that power is likely again to regain its ascendancy over the neighboring tribes. Coomassie was ruined during the civil war, but is being rebuilt. Human sacrifices are now forbidden by the new king, Quaco Duah.——A Portuguese expedition under Major H. de Carvalho left Loanda June 10th, with the object of establishing commercial relations with the Muata Yanvo. Thence the expedition will proceed to Mozambique. (A Portuguese, Joaquim Rodriguez Graca, 1845–7, was the first to make known in Europe the kingdom of the Muata Yanvo.)——The German African Association has sent out a new expedition for the exploration of the southern part of the Congo basin, under the command of Lieut. E. Schulze, with Lieut. Kunth as topographer, Dr. Wolff as anthropologist, and Dr. Buttner as naturalist.——According to M. de Foucauld, who has recently returned to Paris from a journey in Morocco, the sultan of that country (Mulai-el-Hassan) has only an extremely limited authority, since many tribes are not only rebellious, but independent. His empire is really bounded by the lower valleys of five large rivers, *i. e.*, to the parts occupied by the Arab race. The vast regions peopled by Imaziren (Berbers) recognize no power save their own chiefs. The conflict of influences on the Congo has caused the invention in Germany of a "Game of Congo" in which sixteen pawns, bearing the colors of England, France, Germany and Portugal, operate on a large map.

AMERICA.—*The Work of the Greely Expedition.*—The geographical work of the Lady Franklin Bay Expedition, according to the account given by Lieut. Greely at the British Association, covers nearly three degrees of latitude and over forty degrees of longitude. Lieut. Lockwood's journey to the north added nearly 100 miles of coast line beyond the farthest point seen by Lieut. Beaumont, of the Royal Navy. There were no indications that the most northern point of Greenland seen, 83° 35′ N. lat., 38° West long., was the northern termination of Greenland. The coast presented numerous fjords, with many outlying islands, and the interior, as seen from an elevation of 2000 feet, consisted of confused masses of eternally snow or ice-clad mountains. The coast-line was high and precipitous, the formation schistose slate with a little quartz. The arctic poppy and several saxifrages were seen, as were also traces of the polar bear, lemming and arctic fox, and a hare and a ptarmigan were killed. A snow bunting was heard. A curious fact was the existence of a "tidal crack" extending from Cape Bryant along the entire coast, stretching across the fjords in a direct line from headland to headland, and varying in width from one yard to several hundreds. Inside the crack was rough hummocky ice, while outside lay the palæocrystic ice. The interior of Grinnell land from the 81st to the 82d parallels, between Kennedy and Robeson channels and the Western Polar ocean, was found entirely free from snow in July, except on the very backbone. Vegetation abounded, willows, saxifrages, grasses and other plants completely covered large tracts of ground. These valleys afford good pasturage for musk cattle which feed toward the sea-coast in the summer and withdraw to the interior toward winter. Raised beaches, marine shells and driftwood indicated the recent elevation of this region above the sea. From the 81st parallel southward to Hayes sound between the heads of Archer and Greely fjords, stretches the perpendicular front of an ice-cap, the average height of which is not less than 150 feet. From the summit of Mount Arthur (4500 feet) a similar ice-cap could be seen north of the Garfield range, with extensive glaciers projecting through each mountain gap. The southern limit of this cap closely coincides with the 82d parallel, and its area must be about 6000 square miles. The line of perpetual snow on Mount Arthur was 3500 feet above the sea, while the crest of Grinnell Land was 2500 above the sea in front of the southern ice-cap, and 3000 feet near Mount Arthur.

GEOLOGY AND PALÆONTOLOGY.

THE STRUCTURE OF THE COLUMELLA AURIS IN CLEPSYDROPS LEPTOCEPHALUS.[1]—The columella auris in *Clepsydrops leptocephalus* Cope, is bifurcate at the proximal extremity. The shorter expanded

[1] Abstract of paper read before the National Academy of Sciences Oct. 16, 1884

extremity is the stapes proper. The oblique perforation of its base is a character which has not been hitherto observed in any reptile, not even in the allied form Hatteria (Huxley). If, as is probable, the perforation is homologous with the foramen of the mammalian stapes, we have here another point of resemblance to this class. The longer proximal branch of the columella has only half the width of the stapedial portion, and its long axis makes an obtuse angle with that of the latter. It is perhaps the ossified suprastapedial cartilage of Huxley, which that author states (Anatomy of Vertebrated Animals, p. 77) is not ossified in any of the living Sauropsida. Huxley supposes this cartilage to be the homologue of the incus, and remarks[1] that in a young Mammalian fœtus "it appears exactly as if the incus were the proximal end of the cartilage of the first visceral arch." This identification will require an excessive abbreviation of the stapes in Clepsydrops, and until this is proven I prefer to call this process the *epicolumella* (see Pl. XXXVIII, fig. 2). The columella now described, resembles a rib, of which the epicolumella resembles the head, and the stapes the tubercle. If this process be the incus, the stapes is shortened as in the majority of Mammalia, unless the primitive suture between the two be longitudinal. The form and position of the true stapes give support to the view of Salensky, that it is not part of a true visceral arch, but is developed in the connective tissue surrounding the mandibular artery. We see that in this Pelycosaurian it is not the proximal part of the arch, and surrounds the mandibular artery. The columella is divided into at least two distinct elements. This is clearly indicated by its abrupt truncation distally by a rough sutural surface. If there be but one bone distad to the stapes, it is homologous with the cartilage, which has been shown by Peters[2] to be distinct in Hatteria, crocodiles and various lizards. It is the triangular ligament of Cuvier. If the suprastapedial be incus, this element is malleus; and it is usually identified as such by the older anatomists. In this structure we have evidence that the hypothesis that the articular and quadrate bones are homologous with the ossicula auditus, is incorrect. The Pelycosauria will probably come under the head of "Sauropsides malleoferes" of Albrecht. We have here an approximation to the Mammalia in two points: (1) The perforation and ? shortening of the stapes; (2) and the ossification of the incus, which (3) is distinct from the malleus, thus furnishing homologues of the principal ossicles of the ear. It is unnecessary to observe, however, that this part of the skeleton does not resemble the corresponding part in the known Monotremes.

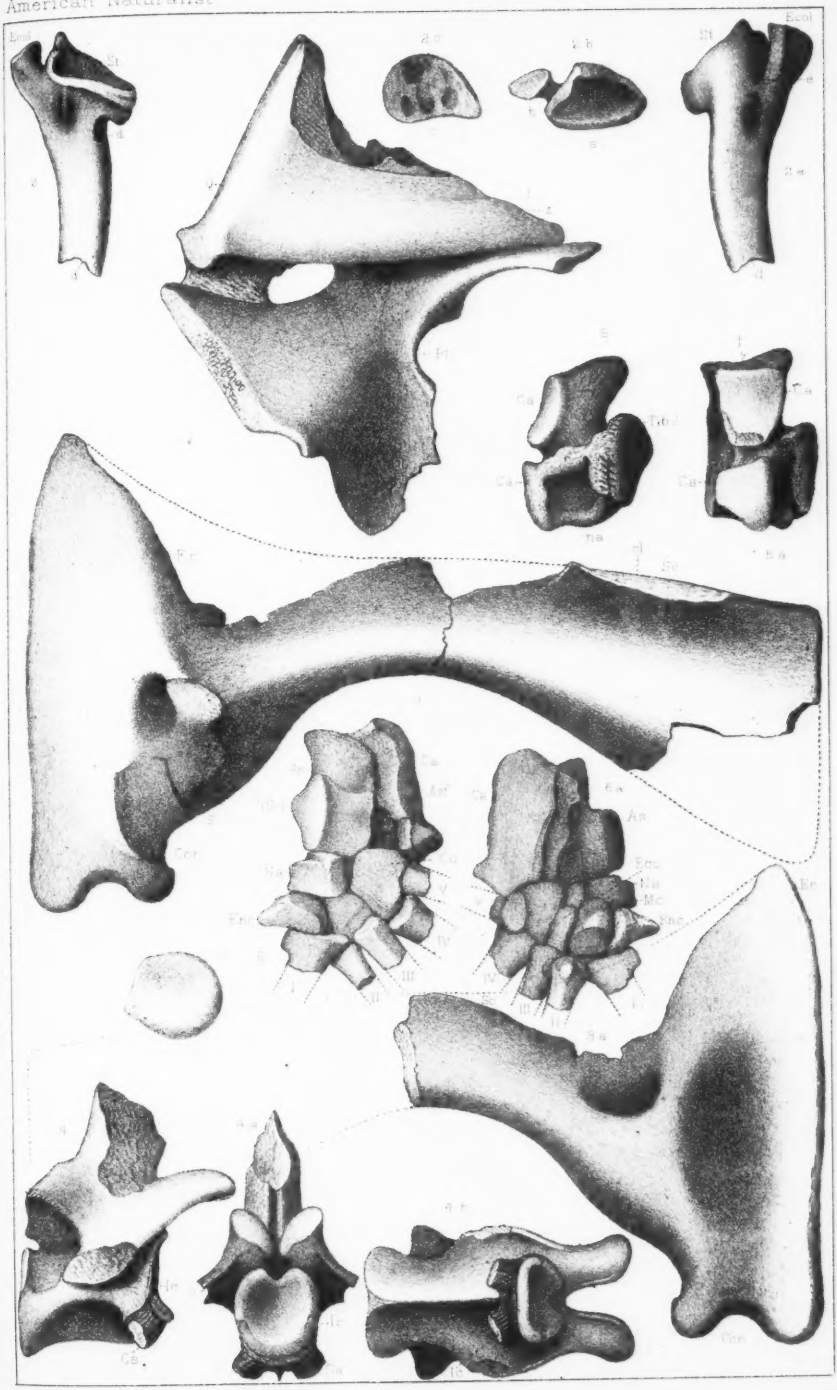
EXPLANATION OF PLATE XXXVIII.

(I am indebted to the American Philosophical Society for the use of this plate.)

FIG 1.—*Clepsydrops leptocephalus* Cope, right quadrate bone (Q) with condyle and zygomatic process (*z*) from the right, or external side. *Pt*, pterygoid bone of

[1] Proceedings Zool. Society, London, 1869, p. 391.

[2] Monatsberichte der Academie Sciences, Berlin, 1868 (p. 592)—1870.



BONES OF PELYCOSAURIA

same side displaced so as to be in plane of quadrate, and to be seen from inferior side. One-half natural size.

FIG. 2.—Columella auris of the individual of *Clepsydrops lèptocephalus* represented in fig. 1; internal side. Fig. 2*a* external side; 2*b* proximal extremity; 2*c* distal extremity; *st*, head of stapes; *ecol*, epicolumella; *d*, distal articular surface, especially represented in fig. 2*c*. All figures are half natural size, excepting 2*c*, which is natural size.

FIG. 3.—Left half scapular arch of a Pelycosaurian, less clavicle and episternum, one-half natural size. *sc*, scapula; *cl*, facet for clavicle; *cor*, coracoid; *ec*, epicoracoid; *s*, open suture between coracoid and epicoracoid, indicating the immaturity of the animal.

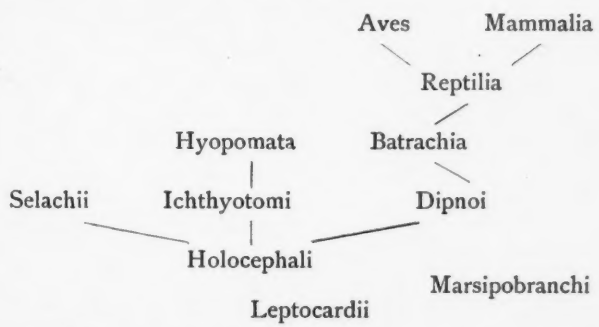
FIG. 4.—Dorsal vertebra of a species of Embolophorus, one-half natural size; right side; *a*, from front; *b*, from below. *ic*, intercentrum; *ca*, capitular rib articulation.

FIG. 5.—Astragalus of individual figured in fig. 4, one-half natural size; from below. *ca*, *ca*, facets for calcaneum; *na*, do, for navicular; *tib* 2, do, for bone of spur, or os tibiale. 5*a*, same bone from external or calcaneal border; *f*, fibular facet. 5*b*, same bone, proximal or fibular extremity.

FIG. 6.—Left posterior foot of *Clepsydrops natalis* Cope, superior side, and 6*a* inferior (plantar) side, two-thirds natural size. *as*, astragalus; *ca*, calcaneum; *na*, navicular bone; *cu*, cuboid; *enc*, *mc* and *ecc*, entocuneiform, mesocuneiform and ectocuneiform bones, respectively, I, II, III, IV, V, metatarsals. In this specimen the calcaneum is displaced, being turned backwards, so as to present its two astragalar facets (*asf*) anteriorly.

—*E. D. Cope.*

NOTE ON THE PHYLOGENY OF THE VERTEBRATA. — As my researches have now, as I believe, disclosed the ancestry of the mammals,[1] the birds,[2] the reptiles, and the true fishes,[3] or Hyopomata, I give the following phylogenetic diagram illustrating the same. This will only include the leading divisions. The special phylogenies of the Batrachia[4] and Reptilia,[5] and some of the Mammalia[6] have been already given.



[1] AMERICAN NATURALIST, 1884, p. 1136.
[2] Proceedings Academy Philadelphia, 1867, 234.
[3] Proceedings American Philosoph. Society, 1884, p. 585.
[4] AMERICAN NATURALIST, 1884, p. 27.
[5] Proceedings American Association for the Advancement of Science, XIX, 1871, 233.
[6] Proceedings American Philosophical Society, 1882, 447; AMERICAN NATURALIST, 1884, p. 261 and 1121; Report U.S. Geol. Survey W. of 100th Mer., G. M. Wheeler, 1877, IV, II, p. 282.

The Mammalia have been traced to the Theromorphous reptiles by the Monotremata. The birds, some of them at least, appear to have been derived from the Dinosaurian reptiles. The reptiles in their primary representative order, the Theromorpha, have been probably derived from the Rhachitomous Batrachia. The Batrachia have originated from the sub-class of fishes, the Dipnoi,[1] though not from any known form. I have shown that the true fishes or Hyopomata have descended from an order of sharks,[1] the Ichthyotomi, which possess characters of the Dipnoi also. The origin of the sharks remains entirely obscure, as does also that of the Marsipobranchi. Dohrn[2] believes the latter class to have acquired its present characters by a process of degeneration. The origin of the Vertebrata is as yet entirely unknown, Kowalevsky deriving them from the Ascidia, and Semper from the Annelida.

It is now possible to determine the nature of the evolution of the greater number of the vertebrata, by resolving the difficult problem of distinguishing primitive from degenerate types. By degeneration I understand loss of parts and organs which subserve what would be usually called animal vitality, as distinguished from vegetative life. Preëminent among these must be regarded varied powers of movement, which give the greatest opportunity for the exhibition of intelligence. *Loss of parts without complementary development of other parts is the usual form of degeneration.*

Among the true fishes there are several examples of degeneration. Among Physostomi the marine eels (order Colocephali) exhibit this in their skulls and fins, the final degradation being reached by the deep-sea form, the Eurypharyngidæ. In Physoclysti, the group with abdominal ventral fins descended through the Hemibranchi to the very degraded type of the Lophobranchi. The group with pectoral ventral fins, especially the Percomorphi, present us with a degraded type of the Plectognathi. The descent commenced in the suborder Epilasmia (Chætodontidæ, Teuthyidæ, etc.).

The Batrachia are almost entirely a line of degradation. It is now quite safe to say that the Trachystomatous order (Sirenidæ) is a degraded, and not a primitive type.

The lines of Reptilia which terminated in the existing orders is a line of degradation. In comparison with the Theromorpha, the Crocodilia are degraded, and the Lacertilia are still more so. This latter order displays within itself the most remarkable number of degraded forms, as I can agree with Dr. Boulenger in calling them. Among snakes, the Typhlopidæ and their allies are a degraded type, but the order displays an ascending scale on the whole. Two extinct orders of Reptilia show ascending

[1] Proceedings American Philosoph. Society, 1884, p. 585.

[2] Der Ursprung der Wirbelthiere u. d. Princip des Functionwechsels. Von Anton Dohrn, Leipsic, 1875, p. 32.

lines, viz., the Dinosauria and the Pterosauria, one or both of which terminated in the birds.

The birds appear to form an ascending series, with few or no exceptions.

The line of the Mammalia is mainly ascending. Probable exceptions are the Edentata, the Sirenia and the Cetacea.—*E. D. Cope.*

The Permanence of Ocean Beds.—Rev. O. Fisher publishes a letter in the *Geological Magazine* for September, in which he strongly supports the doctrine of the permanency of the ocean beds, closing as follows:

"Extensive changes of level seem to me to be the most difficult to account for of all the phenomena of geology. And the greater the changes, the greater the difficulty. The permanence of the respective areas seems therefore to involve less difficulty than their interchange. I published in *Nature* (Jan. 12, 1882), a suggestion to account for the origination of ocean basins. It is rather remarkable that the first and only allusion to it which I have seen has just now come from New Zealand in Dr. Haast's address at Canterbury College. Accepting Professor Darwin's theory that the moon broke away from the earth more than fifty million years ago, I think the ocean-basins may be the scar that was formed, and that the basement rocks of continents are fragments of the crust which had already solidified, and which were left behind. It has since occurred to me that the archæan rocks may be the veritable remains of it. I would refer to my published article for the details of the grounds on which I think this theory plausible. Dr. Haast uses rather too strong an expression in saying that I have attempted to prove it. It is probably incapable of proof, even if true."

Systematic Position of Lepidodendron, Sigillaria and Stigmaria.—According to the Journal of the Royal Microscopical Society for August, B. Renault maintains his previous view as to the relationship of these fossil plants against the objections of Williamson and Hartog. He considers that those Sigillariæ which can be determined with certainty belong to the Gymnosperm type, while the species of Lepidophlois have the characteristics of Lycopodiaceæ. Stigmariæ must be regarded partly as rhizomes of Gymnosperms; the anterior portions must have had only leaves with monocentric vascular bundles, the anterior part, after the fall of the leaves, only adventitious roots with tricentric vascular bundles; while in the middle were both roots and leaves. This may serve to explain the conflicting descriptions of various writers.

Geological Notes.—*General.*—The German Expedition has brought back the information that the island of South Georgia is composed of clay slate. This was not only found in situ, but taken from the débris brought down by the glaciers from the in-

terior. Varieties of quartz were interspersed in some places, and the rock contained a little iron, insufficient to affect the needle. The mountains are from two to three thousand metres in height. ——Dr. Carl Ochsenius, of Marburg. discusses, in a recent number of the *Geological Magazine*, the origin of metalliferous deposits, and states that his conclusions, as evidenced by extracts from the Journal of the German Geological Society, August, 1881, agree substantially with those arrived at by Professor Joseph Le Conte, and put forth in the *American Journal of Scicnce*, July 1883. To the words of the latter, "thus then subterranean waters of any kind, but especially alkaline, at any temperature, but mostly hot, circulating in any direction, but mainly upcoming, and in any kind of water may, but mainly in open fissures, by deposit form metalliferous veins." Dr. Ochsenius would add, "if they contain sufficient quantities of ores in solution," since many alkaline and saline springs and waters form no metalliferous deposits. He says, "Metalliferous deposits are in fact constituted of metallic particles, extracted from rocks by mother liquors, either with or without the operation of carbonic acid, and accumulated in fissures, cavities, or depressions. Mineral springs found in many metalliferous regions evidence the former activity of mother liquors."——Mr. W. T. Blanford states that it appears doubtful if the sedimentary formations of India can be accurately classified by means of the European subdivisions, and that he believes that the European classification can only be applied as an artificial scale or measure of comparison. He advocates the union of the Cambrian and Silurian, and considers the Devonian-Carboniferous-Permian as forming a second main division of Palæozoic. "Permian" does not occur in Asia. In the Indian Salt Range section, the upper series of the Carboniferous or Productus limestone series contains more Triassic forms than the Magnesian limestone of Europe. The Rhætic he considers as the upper member of the Triassic system, and advocates the Tertiary classification recommended by several German and Swiss geologists, viz., the union of the Oligocene with the Eocene, and the grouping of all the higher strata as Neogene or Mollasique.——The Permian (as commonly understood) has recently been roughly handled by the Rev. A. Irving, who shows that the Bunter and Mergel-Schiefer are Triassic, and are so regarded by German geologists, while the remainder of the so-called Permian, consisting of the marine Zechstein and the Rothliegende (a fresh water and land-formation with included eruptive rocks, parallel with the Zechstein) form the Dyas of the Germans. This Dyas may well be grouped with the Carboniferous.

Jurassic.—The stratigraphy of the middle Jurassic to the east of the Paris basin is elucidated by Wohlegemuth in a separate issue of the Academy of Sciences of Nancy. The middle and upper Bathonian, Callovian with *Ammonites athleta, anceps,* and *macrocephalus*, Oxfordian, Corallian with *Diceras arietinum* and

Cidaris florigemma, and the lower Kimmeridge or Astartian are described.

Cretaceous.—A neuropterous insect (*Æschna? flindersiensis*), two trilobites and five molluscan species, including an Avicula and a Modiola, have been described by Dr. H. Woodward and W. H. Hudleston from the Cretaceous of Australia (*Geol. Mag.*, August).

Pleistocene.—Our knowledge of the glaciers of Europe is further increased in a paper by Edward Richter, in the zeitschrift of the German Alpine Club, entitled, "Observations on the Glaciers of the Eastern Alps, (I) the Obersalzbacher Glacier."——The Neues Jahrbuch für Mineralogie, Geol. and Palæon., 1884, notices the work of J. Partsch upon the ancient glaciers of the Carpathians and Central Germany, and that of A. Penck upon the glaciation of the German Alps, their causes, periodical retreat, and influence over the topography of the region covered by them. Penck divides the ice-period in the neighborhood of Innsbruck into six periods, concluding with the erosion of the Valley of the Inn, the formation of ravines on the terraces, and the deposition of moraines in them.——The same issue notices an account by Sr. Pereira Cabral of the superficial deposits of the basin of the Douro, around Oporto.

MINERALOGY.[1]

Leucite from Lower California.—The history of leucite is very interesting. Some thirty years ago Humboldt made the general statement that leucite occurred nowhere outside of Europe. Curiously enough, until within a few years this statement held good. In 1874, however, Vogelsang found it in an Asiatic basalt, and, in 1876, Zirkel announced its discovery in Wyoming Territory, U. S.

Although the leucite was invisible to the naked eye, Zirkel's discovery was regarded so important that the locality was named by the U. S. Geological Survey the *Leucite Hills*. An interesting commentary on the influence of modern science is furnished by a name so given.

Another extra-European locality for leucite is now announced by Von Chrustschoff[2] who finds it in a lava in the vicinity of the volcano "Cerro de las Virgines" in Lower California. The rock consists of an ash-gray ground-mass sprinkled with rounded spots of brownish-black obsidian or glass, and with light specks of leucite. These light specks are shown by a lens to have a rounded octagonal outline. Augite and olivine also occur porphyritically, and in the grondmass plagioclase, magnetite, nephe-

[1] Edited by Professor H. Carvill Lewis, Academy of Natural Sciences, Phila.
[2] Min. u. Petrograph. Mitth., 1884, vi, 160.

line, mica, glass, and perhaps melilite can be found by the microscope.

The leucite is remarkably clear and fresh, and shows in polarized light the well known twinning structure, even better marked than in the leucite of the Vesuvian lavas or of the Laacher-See. While generally in rounded masses, the smaller individuals are often clearly octagonal in outline. The microscope shows the leucite to contain many inclusions, among which are augite, apatite, olivine, plagioclase, magnetite, nepheline and glass inclusions and bubbles.

Leucite has as yet never been found in rocks of pre-Tertiary age.

ENARGITE FROM MONTANA.—An arseniferous copper ore from Montana has been examined by Mr. Wm. Semmons,[1] who has found in it crystals of a mineral resembling enargite. The crystals are rare and small. They show prismatic and pinacoidal planes, the macro- and brachydomes and the basal pinacoid, and are apparently orthorhombic. They are highly striated, like stibnite, and cleave into little rhombic prisms. H = 2.5. Spec. grav. = 3.92. Soils the fingers. Color lead-gray when freshly broken, tarnishing on exposure, and then resembling blende. Streak black. Before the blowpipe it decrepitates and exfoliates into worm-like threads like vermiculite, and gives reactions for sulphur, arsenic and copper.

Composition: mean of two analyses:

Cu	As	S	SiO_2	Fe	
45.78	18.65	31.30	2.50	.80	= 99.03

As the hardness, the cleavage and the blowpipe characters differ from typical enargite, although the composition is the same, it is possible that this is a distinct species falling among such other sulph-arsenites of copper as famatinite, clarite, luzonite and guayacanite. It is desirable that crystallographic measurements should be taken.

LAZULITE FROM GEORGIA.—The beautiful lazulite occurring at Graves mountain, Lincoln county, Georgia, has long been known, but has until now not been investigated optically. It is in fine sky-blue crystals often over an inch in length and in width. Von Lasaulx[2] of Bonn has recently examined it optically. Fine pleochroism was noticed, the crystal being colorless in one direction of elasticity, and sky-blue in the two others. The optic axes lie in the plane of symmetry, their divergence in air being 110°. The angle between the bissectrix (negative) and certain known planes is also given. The microscope showed that the lazulite

[1] *Mineralogical Magazine*, 1884, VI, No. 27, p. 49.

[2] Sitzungsber. der niederrhein. Ges. für Natur. und Heilk. December, 1883, p. 274.

was not homogeneous, being traversed by rutile and by other undetermined substances.

MINERALOGICAL NOTES—Professor Bonney[1] publishes an account of a case of the replacement of quartz by fluor spar. The rock in which it occurs is a mixture of red felspar, fluor spar and tourmaline, and has been named "Trowlesworthite"[2] by Mr. Worth. It is believed that the rock has been formed from granite through the replacement of quartz by fluor spar. This is an unusual substitution.

Professor W. P. Blake[3] has found *columbite* associated with cassiterite, albite and mica in several of the coarse granite veins which traverse the mica schists of Pennington county, Dakota. One mass of columbite was two feet long by twenty inches wide, and must have weighed a ton. In the cavities in the columbite he found a beautiful yellow powder in pellets and pill-like balls, consisting of nearly pure hydrous uranium oxide.

Garnet is reported by H. Louis[4] as occurring in the form of an igneous dyke in the province of Catalonia in the Pyrenees. The dyke varies in thickness from two to five and a half feet and is vertical. It is made of pure garnet free from admixture of other minerals.

The discovery of *herderite* at Stoneham, Maine, described by Mr. W. E. Hidden[5] about a year ago, and analyzed by J. B. Mackintosh, was of considerable interest. It had previously been found only at Ehrenfriedersdorf, Saxony, where it was very rare. In a recent note[6] Professor A. Wiesbach gives the results of a comparative chemical examination of the Saxon and Maine herderite, made at his suggestion by Dr. C. Winkler. These investigations showed remarkable discrepancies between the herderite from the two localities and also between the analyses of Mr. Mackintosh and himself. It was therefore desirable to re-examine the mineral, and Dr. F. A. Genth,[7] of the University of Pennsylvania, undertook a new analysis, with the result of confirming that of Mr. Mackintosh and disproving those of Dr. Winkler. The latter is shown to have employed incorrect methods of analysis, thus losing the fluorine and part of the glucina. Dr. Genth states that "there can be very little doubt that the Ehrenfriedersdorf and Stoneham mineral are identical in composition."

[1] *Mineralog. Magazine*, 1884, VI, p. 48.
[2] Trans. Royal Geolog. Soc. of Cornwall, Vol. X, p. 177.
[3] *Amer. Jour. Sc. and Arts*, November, 1884, p. 340.
[4] *Mineral. Magazine*, July, 1844, p. 46.
[5] *Amer. Journ. Science*, XXVII, 135.
[6] Neues Jahrb. d. Miner., 1884, II, 134.
[7] Proc. Amer. Philos. Soc, Oct. 17, 1884.

BOTANY.[1]

NOTES ON THE STRUCTURE OF THE FLOWERS OF ZYGADENUS GLAUCUS NUTT.—The plant is found in low prairie lands near Dayton; it arises from a coated bulb, the last one or two leaves of which subtend buds that are to form the bulbs of next year. In addition to these bulbs the plant sometimes puts forth a short stem scarcely an inch long at the end of which a bulb and roots are developed. This stem originates in the parent bulb, but just where, I neglected to determine. The flowers are borne in panicles, are nearly erect, and permit the insect visitors to walk easily about on the leaves of the greenish-white perianth, sipping the excretion from the obcordate green glands (Fig. 3). The excretion had a disagreeable taste, and was not sweet. The open nature of the flower would suggest the visits of chiefly diptera, and such were the only visitors I saw. In the bud, stamens and styles are erect. The anthers are heart-shaped, confluently one-celled and extorse. The three outer stamens mature first, then the three inner stamens, recurving until the anthers face the glands (Fig. 1). After dehiscence the stamens again assume an erect position and the styles begin to grow in size and recurve until the stigmas assume the positions first held by the anthers (Fig. 2). There is no provision made for the protection of the gland excretion. The first rain could wash it away. All insects can readily get at it. But the disagreeable taste is sufficient to keep away most unwelcome visitors. Bees seem to evade it for better plants and probably the taste of the nectar adapts this plant as perfectly to flies as the more complicated structures do to higher insects. The unsightly colors are also noticeable in this respect.—*Aug. F. Foerste, Granville, Ohio.*

FIG. 1.—Male state of flower, natural size, with the stamens recurved. FIG. 2.—Female state of flower, the stamens now erect, and the three stigmas, *st*, recurved. FIG. 3.—Upper surface of a perianth leaf (slightly enlarged) showing a gland at *gl*.

CONCERNING THE MANNER IN WHICH SOME SEEDS OF GRASSES BURY THEMSELVES IN THE SOIL.[2]—You are doubtless all more or less familiar with the experiments of Francis Darwin and a few others before him on the power of seeds of Stipa, Erodium, Heteropogon, Avena, and other plants to bury themselves beneath the surface of the soil. Mr. Darwin's account is the best, and can be found in the transactions of the Linnean Society for 1876

[1] Edited by PROFESSOR C. E. BESSEY, Lincoln, Nebraska.
[2] Read before the Botanical Club of the A. A. A. S.

When dry, the awns of these seeds or fruits twist about, leaving a considerable portion of the untwisted part of the awn at the tip spread out at nearly right-angles to the rest of the awn. If wet, the awn untwists and becomes straight. The apex is sharp, and is usually supplied with short, stiff hairs, which act as barbs to a spear, and help hold all that is gained as the apex pushes or bores forward. These seeds usually fall to the ground among straws, stubble, and more or less rubbish. If the awn is held in place, the motion takes place in the grain.

Some years ago in repeating this experiment, I placed a box of earth full of small sticks or straws every inch or so over the surface. This was to act as stubble, and by holding the awn, help the seeds to penetrate the ground. The seeds worked well, some of them (*Stipa spartea*) boring down two inches to the bottom of the box.

Later I tried some in a box of earth without any straws or sticks, and was surprised to find that they all but one, in fifty or more, had no trouble in penetrating the soil. The seeds of some species penetrate the skins of sheep and dogs and become quite troublesome. I have recently been studying the grain of three species of grass with reference to this subject.

After dry weather where some tall oat-grass (*Arrhenatherum avenaceum*) had gone to seed before it was cut, the land in places had cracked in drying. There was considerable litter among the plants on the ground. It was very interesting to see that the seeds had nearly all twisted their way down under this litter of straws, dead leaves and other rubbish. Every little hole and crack in the dried earth was stuck full of these seeds with the base end down bringing the embryo farthest into the ground. Some of the seeds had gone down an inch or so into the cracks.

On the last of July we had some days of wet weather which caused the cracks in the soil to close up against the seeds; the pattering drops of rain scattered more or less earth into the holes and cracks over the seeds and they began to grow freely.

Large quantities of seeds of *Anthoxanthum puelli*, a species of small sweet vernal, behaved just as well as those of oat-grass. They found the cracks and crevices; the litter served as a mulch; the seeds started to grow. In a thin place on the lawn some seeds of *Danthonia spicata* were observed. They bored down as well as those of the two former plants, but in this case large numbers of ants were busy in their excavations, thus making small hills, usually not more than an inch high and three inches in diameter. Numerous seeds of Danthonia were already sprouting and the young plants were coming out of the fresh earth where they had buried themselves or had been buried by the ants. Numerous mole hills in the vicinity might also have served as newly prepared ground for these seeds, had the plants grown just there.

A few weeks ago, some boxes were half-filled with good garden

soil. The surface seemed quite even, though there were some small lumps half an inch or more in diameter, and a few irregular, narrow depressions here and there. On the soil were scattered in the several boxes, seeds in the chaff of the three grasses named. There were no artificial obstructions placed in the soil, which was alternately wet and dried quite a number of times, till nearly all the seeds disappeared below the surface and some of them, even when the surface was quite dry, began to send up green leaves. Thus we see that even the weak and short twisting awns of some grasses are of use in covering the seeds with soil.—*Dr. W. J. Beal, Agricultural College, Mich.*

New Species of North American Fungi (*Continued*).—*Phyllosticta leucothöes.*—Apical portion, or often the entire upper half of the leaf discolored, rusty brown, the discolored part distinctly limited. Perithecia globose 150–200μ in diam., few and scattered, buried in the substance of the leaf, their apices slightly prominent above, but covered by the epidermis; spores ovate-oblong, 15–21 × 6–7μ, granular or with 2–3 nuclei. Differs from *P. terminalis* E. and M., to which it bears a general resemblance in the different color of the affected part and in its much larger spores. On leaves of *Leucothöe acuminata.* Green Cove Springs, Fla., January, 1884.

Phyllosticta sinuosa.—Spots orbicular, 1.5–6^{mm} (mostly 2–3^{mm}), reddish-brown, becoming nearly white with a distinct raised, reddish-black border; perithecia epiphyllous, scattered, lenticular (150μ) mostly near the margin of the spots; spores oblong or clavate-oblong, hyaline, 3½μ (undeveloped)?–15μ and 1½–2μ wide. On leaves of *Olea americana.* Green Cove Springs, Fla., February, 1884.

Phyllosticta corylina.—Spots red-brown, round (2–5^{mm}) or oftener coalescing and continuous along the edge of the leaf, perithecia brown-black, erumpent, lenticular, amphigenous (90–120) on very short basidia; spores subhyaline, oblong, mostly with a nucleus in each end, 12–15 × 6–7μ. This appears to differ from *P. coryli* S. and S. and from *P. corylaria* Sacc. in its larger spores and the different character of the spots. On leaves of *Corylus americana.* Newfield, N. J., August, 1884.

Phyllosticta apocyni.—Epiphyllous on brown, round definitely limited spots (1–2^{mm}), with a slightly raised narrow border; perithecia subglobose, erumpent, mostly in the center of the spots, 75 dia n., spores globose or ovate, 7–9μ with granular contents, larger than those of *P. asclepiadearum* West. On leaves of *Apocynum cannabinum.* July.

Sacidium polygonati.— Perithecia flattened, globose or elliptical, 200–230μ in diameter; astomous, of compact, subradiate cellular structure; spores subglobose or subangular by compression, 5–7μ. On dead stems of *Polygonatum giganteum.*—*J. B. Ellis, Newfield, N. J., and Dr. Geo. Martin.*

THE DEATH OF GEORGE BENTHAM.—This eminent man, whose name is familiar to every botanist, died on the 10th of September at his home in London, England, at the advanced age of eighty-four years. He was born at Plymouth, September 22, 1800. The years from 1814 to 1826 were spent in southern France, a result of which was his first botanical publication, a Catalogue of Plants Indigenous to the Pyrenees and Bas Languedoc, issued in 1826. In 1854 his great herbarium and library were given to Kew, and here he worked assiduously upon genera and orders of plants, the results of which appeared from time to time in the form of unrivaled monographs. The greatest work of his life was that upon the Genera Plantarum, began in 1862 and completed in 1883, the joint product of Mr. Bentham and Sir Joseph Hooker.

NOTICE.—CHANGE OF ADDRESS.—The editor of this department having accepted the chair of botany and horticulture in the University of Nebraska, should hereafter be addressed at Lincoln, Nebraska.

BOTANICAL NOTES.—Dr. Vasey has again placed the botanists of the country under obligations to him by bringing out a thick pamphlet entitled The Agricultural Grasses of the United States. A proper notice will be given of it in the future, but we must stop long enough to commend this as a sample of the kind of publications which are creditable to the department of agriculture. Unfortunately many of its publications have been far from creditable.——In recent numbers of the *Gardener's Chronicle* Thos. Meehan publishes a valuable article on the fertility of hybrids, from which we hope to be able to make extracts at an early date. ——In the same journal for September 27, W. G. Smith gives an account of the growth of the little fungus *Schizophyllum commune* upon the cut edge of ensilage in a silo. This is surely an odd place for it to grow, but it sounds oddly to learn that "the fungus is a common one in the tropics, rarely spreading into temperate regions." It is, as every collector well knows, one of our most common fungi the year round, growing upon sticks and timber everywhere.——The Ninth Annual Report of the Montreal Horticultural Society contains an interesting paper by Professor Penhallow on the trees and shrubs of northern Japan.—— The September *Torrey Bulletin* contains a paper by J. H. Redfield, giving the known localities of *Corema conradii*, from which it appears that it occurs upon the (1) New Jersey pine barrens, (2) upon Long Island, (3) at Plymouth, Mass., (4) Bath, Me., (5) Isle au Haut, Me., (6) Nova Scotia and Newfoundland, (7) Shawangunk mountains, N. Y.——In the same number is a convenient list, by A. F. Fœrste, of the changes in nomenclature as they occurred in Gray's Synoptical Flora, Vol. I, part II. There are about a hundred changes, but it does not follow that "about one-fourth of

the species are to receive different names," as the writer of the paper remarks, for by a strange slip of memory the volume is said to enumerate " less than 400 monopetalous [sic] species from Caprifoliaceæ to Compositæ inclusive." The Compositæ alone include nearly four times that number!

ENTOMOLOGY.

GREAT SWARMS OF A PSEUDO-NEUROPTEROUS INSECT IN JAPAN.—On the 17th February of this year (1878), at about 7 o'clock A.M., this curious kind of insect (in the bottle) was seen at Yunosawa, in the district of Kameda, near Hakodate port, flying in swarms of so great numbers that for the distance of about four or five chios (1440 to 1800 feet) it seemed quite dark. At this time they were very small and looked like gnats or mosquitos. But about one hour afterwards they seemed to grow as big as a small sort of fly, and each pair copulated together for several hours, and then they all fell down dead.

This insect was also seen on the 29th December last year (1877). The residents of that place stated that they had never seen any before there, even in summer, and they considered it very strange that such insects were found there in the season of snow, especially during this severe winter.

Yunosawa is situated in a small valley. A small stream runs through this valley, and at its bank there is a lime manufactory, besides only one farmer's house, and a few rice fields, also a hot spring in this valley.

I have the honor to request you will be kind enough to examine the accompanying specimens of some curious insects lately found at Yunosawa, and shall be glad if you can give me some information regarding them.—*Aritake Yutaka, Kaitaku Wosakwau.*

[The insects were sent to Dr. Hagen who pronounced them a species of Capnia.—*Ed.*]

THE LARVAL STAGES OF MAMESTRA PICTA.—In the middle of September, 1876, the caterpillars of this moth did extensive injury to the ruta bagas on the farm of the Massachusetts Agricultural College at Amherst; eight years previous they also destroyed the leaves of this vegetable as well as the beet. The following descriptions may be of service as data for a comparative study of the early stages of the Noctuidæ:

Larva before the 1st moult.—Length 4$^{mm.}$ Head as wide as the body, pale-greenish; body pale-greenish with a double dark livid dorsal stripe divided by a pale median line; three lateral dark stripes, of which the uppermost is the narrower; five pairs of abdominal feet, first pair one-half the size of the fourth pair. Body well tuberculated, being smoother in the adult.

Larva after the 1st moult.—Length 7$^{mm.}$ Markings much as in the full-grown larva, deep yellow with a broad black dorsal band,

sometimes entire and sometimes divided by a median pale line. A lateral area marbled with transverse short black and white lines, and with a row of conspicuous black spots. A row of dark spots down on the sides. Head reddish testaceous; abdominal feet reddish.

Larva after 2d or 3d moult.—Length 25$^{mm.}$ Markings as in the full-grown caterpillar, straw-yellow, with a broad dorsal black stripe, and a broader dark lateral stripe; this stripe interrupted by transverse rune-like white markings breaking up the band into similar black runes.

A caterpillar moulted under my eyes; the sides of the head fell off away from the rest of the body, and in an instant the anterior half of the body was pulled out of the old skin; I do not understand where it went to; then in a minute more, stopping occasionally to rest, it withdrew itself from the remainder of its old skin, holding on by its hind legs until they were extricated from the cast skin. The whole process was but the work of one minute. It was but little larger than previous; the prothoracic segment was less spotted and the head much paler than before. By 4 P. M., or about four or five hours after, the head was red-colored, and the six prothoracic black spots had appeared.—*A. S. Packard.*

THE BEES, WASPS, ETC., OF LABRADOR.—Several years ago I named the bees and a few other Hymenoptera which I collected in Labrador during the summers of 1860 and 1864. The specimens are now in the Museum of the Peabody Academy of Science, at Salem, Mass. Of the species of Bombus by far the most common species was *B. lacustris* Cresson, which occurred at Henley harbor, Square island, Sloop harbor and Strawberry harbor; *B. nivalis* Dahlb? occurred at Caribou island, Straits of Belle Isle; *B. frigidus* Smith, occurred at Square island and Hopedale; it also was brought from Nulato, Alaska, by Mr. W. H. Dall; *B. kirbyellus* Curtis, an arctic species, occurred at Sloop harbor and Hopedale. Of the genus Vespa, *V. maculata* flew aboard our vessel at Little Mecatina island, while a nest of *V. norvegica* Fabr. occurred under the turf at Caribou island; it is identical with specimens from Alaska (Dall). *Formica herculanea* was common on the Labrador coast, and is also frequent in northern Alaska. Two species of Sirex occur; besides a common one at Caribou island, a bluish-green species occurs at Hopedale; the stout spine is concolorous with the body, while the legs are yellowish.—*A. S. Packard.*

DANGERS FROM THE EXCREMENT OF FLIES.—The Journal of the Royal Microscopical Society for August, prints an abstract of B. Grassi's experiments which show that flies are agents in the diffusion of infectious maladies, epidemics, and even parasitic diseases.

On a plate on the table of his laboratory he placed a large number of the eggs of a human Nematode parasite (Trichocephalus).

After a few hours, he found, on some white sheets of paper hanging in the kitchen, the well-known spots produced by the excreta of the flies, and on a microscopical examination of these spots, several of the eggs of the parasite were found in them. Some flies coming into the kitchen were now caught, and their intestinal tract was found quite filled with an enormous mass of fæcal matter, in which the presence of eggs of Trichocephali were detected. As it was practically impossible to keep all alimentary substances from contact with these flies, it follows that the chances of Dr. Grassi and his family being infected with Trichocephali were very great. As a matter of fact, the experiment was tried with non-segmented eggs of this worm. Another experiment was in the same direction. Dr. Grassi took the ripe segments of a *Tænia solium* (which had been in spirits of wine), and broke them up in water, so that a great number of the tapeworm's eggs remained suspended in the fluid. The flies came to the mixture, attracted by the sugar, and in about half an hour the ova of the tapeworms were to be found in their intestines and in the spots. Had these eggs been in a recent and living state, they would doubtless have been just as easily transported. To those who care to try these experiments, it is suggested that lycopod powder, mixed with sugar and water, is a good material, as the lycopod spores are easily detected.

It is self-evident that if the mouth-apparatus of the fly will admit of the introduction of such objects as have been above noted, that there will be no difficulty in its admitting scores of the spores of many parasitic fungi, and above all of those belonging to the Schizomycetes, the possible cause of so much disease. Already Dr. Grassi has detected in fly excrement the spores of *Oidium lactis*, and the spores of a Botrytis, this latter taken from the bodies of silkworms dead of muscardine.

There arises, of course, the question of how far the active digestion of the intestines of the fly may not destroy the vitality of germs or spores thus taken in, but it would seem probable that in many instances the larger bodies swallowed may not serve as objects for assimilation, but may be got rid of as foreign bodies, and it will be borne in mind that the flies themselves fall victims to the growth of a parasitic fungus (*Empusa muscæ* Cohn), which is probably taken first into their own stomachs.

Origin of Bee's Cells.—Dr. Dönhoff urges objections to the views of Buffon, carried further by Müllenhoff, that bees' cells are due to pressure, pointing out that there is no relation between the forms of the cells and of the bees' bodies, and that he has observed a single female build a nest consisting of a number of six-sided cells; further, the difference seen in cells formed by bees and drones cannot be correlated with any differences to be found in the inhabitants; in the formation of the queens' cells by

other bees there is no pressure to produce the rhomboid pits; direct observation of the formation of a comb was not rewarded by any indications of pressure; no reasonable amount of pressure on the walls of cells seems to have any effect in altering their form.

The author thinks that Darwin has erred in supposing that the cells have at first the forms which they have later on, whereas this is by no means the case; at first there are nothing but rhomb-shaped spaces, the size of which is gradually increased. Compare also the statements made by Packard in "Guide to the Study of Insects," pp. 121–122, as to the way in which Polistes begins its cells.

ENTOMOLOGICAL NOTES.—The Bulletin of the Brooklyn Entomological Society for October republishes Herrich-Schæffer's synopsis of the "families" of Lepidoptera, with the statement that the table "is not exactly accurate, as applied to our fauna, but it is so far correct that all save a few aberrant forms can be correctly referred by its means." It seems to us a great pity to reproduce an antiquated, in many respects artificial and misleading classification of the Lepidoptera, which may have been useful in Europe, but is not now provocative of good work in America. ——The same journal contains a report of the proceedings of the Entomological Club of the American Association Adv. Science, Philadelphia meeting. Dr. D. S. Kellicott read a paper on the ovipositing apparatus of *Nonagria subcarnea*. Mr. Mann, one of the chief editors of *Psyche*, proposed a combination of the entomological journals of America, a view we heartily advocate. A committee appointed to consider whether such a combination was advisable, reported adversely to any such scheme. We do not see why a well-conducted, responsible journal, well edited, free from crotchets, with articles and departments representing anatomical, systematic, biological and economic entomology, would not meet with support. Meanwhile it is comforting to learn that the American Entomological Society is "wealthy enough to publish everything in the way of long systematic papers presented to it, and the transactions would be the natural avenue for such works." We desire to add that the proceedings and transactions of this society have always been up to high-water mark; if we had no other periodicals, the transactions would worthily represent American entomological science.—— The discussion regarding nomenclature introduced by Professor Fernald was noteworthy in some points. In the course of it, Professor Fernald expressed surprise that Hübner's Verzeichniss genera should be so generally ignored, though his genera were after a fashion described; Mr. Smith stating that Hübner's genera of Noctuidæ would not hold, Professor Fernald added that in the Tortricidæ "Guenee has just as many baseless genera as Hübner has." Mr. Smith discussed the secondary sexual character

of the Noctuidæ and Deltoidæ. Mr. Mann explained how Professor Barnard raised larvæ living in running water. He confined them in a glass tube, one end closed by a porous substance, the other fastened to a faucet. In this way a steady flow of water of any desired strength can be kept up. Dr. Horn stated that, in 1874, when working with Dr. Le Conte on the Rhynchophora, among all their material only a single specimen of *Aramiges fulleri* was contained, and that came from Montana. A year or two after, it was received from all parts of the country, and was dreaded as one of the worst hot-house pests. How did this species spread so suddenly over so large a territory? Professor Lintner had first found the insect in 1876. Professor Dimmock found it very troublesome in hot-houses, especially on roses.——The composition and properties of the light emitted by insects of the genus Pyrophorus forms the subject of a paper recently presented to the Paris Academy of Sciences by MM. Aubert and R. Dubois. The spectrum of the light, examined by the spectroscope, is very beautiful, but destitute of dark bands. When, however, the intensity diminishes, the red and orange disappear, and the green and yellow only remain.——The investigations of M. Carlet enable him to affirm that the poison-apparatus of the Hymenoptera is always composed of two distinct glandular systems, the one with a strongly acid, the other with a feebly alkaline secretion. These two systems unite at the sheath of the sting. The resultant venom is always acid. The action of this venom upon some animals, as rabbits, frogs and certain beetles, is slight, but the domestic fly and the flesh fly are killed immediately by it. The inoculation of a fly with the secretion of one of the glands does not produce death until after a considerable time, but death follows very quickly if the same fly is subjected to a second inoculation, this time with the secretion of the other gland.——M. J. Chatin has studied the basilar piece of the jaw of insects, a part which has been much neglected, yet one of considerable importance. In *Blaps producta*, this portion, which M. Chatin calls the submaxillary, is produced beyond the maxillary.——P. Kirbach (Archiv für Naturgeschichte) gives a description of the structure of the parts of the mouth in the Lepidoptera.——A correspondent writes us as follows: Cape San Antonio is the westernmost point of the island of Cuba. During the whole of the night of the 23d of August, 1884, the lantern of the light-house at that place was surrounded by a cloud of winged insects almost entirely of a bright-red hue, the presence of these causing the light to assume a decided red color; the wind was moderate and from the south-west; the sky was overcast. A few of these bugs have been sent to this city (New York) by Francisco Bautista, the keeper of the light, and identified as cotton-stainers (*Dysdercus sanguinarius* Stal). Though other similar insects have been observed to fly toward lights, this is the first time that

this one has been so reported. It is to be hoped that such dangerous action will not prove chronic with the brilliant and beautiful Hemiptera.——Professor C. V. Riley was awarded a gold medal by the Forestry Exhibition at Edinburgh, in October, for the collection of insects injuring forest trees sent out by the Entomological Division of the Department of Agriculture.

ZOÖLOGY.

THE MOLLUSCAN BODY-CAVITY.—The molluscan forms in general are unlike most of the other metazoan groups in having or seeming to have no body-cavity, the spaces between their organs being filled up with branched cells forming a parenchymatous mass. This fact has led the Hertwig brothers to subdivide the Metazoa above Cœlenterates into two groups, animals with a true body-cavity lined with epithelial cells, including annelids, arthropods and vertebrates, and animals with no such cavity, but with a pseudo-body-cavity of lacunar spaces among amœboid-shaped cells, including Polyzoa, rotifers, plathelminths and Mollusca. Zoölogists generally have been disinclined to accept the view that the parenchymatous tissues of the mollusk are at all comparable with the body-cavity of annelids, etc., and prefer to consider these body-spaces of the mollusks a vastly increased mesodermal mass that has encroached upon the true epithelial-lined body-cavity and greatly reduced its proportions.

It is a constant feature of true body-cavities that they stand in direct communication with the exterior through organs usually excretory in function but also often reproductive. In the Mollusca the pericardium is in direct communication with the exterior through the organ of Bojanus, the molluscan kidney. This has been observed and described in a very large number of Lamellibranchs. Cunningham has recently shown that the kidney in Aplysia[1] and in Patella[2] has openings into the pericardium. Sedgwick has shown the same for Chiton. It has, therefore, been suggested on many sides that in the molluscan pericardium we have the remains of a body-cavity, but shrunken here to very small dimensions. Upon this view the very characteristic form of the molluscan kidney and pericardium becomes intelligible.

In a paper by Von Ihring[3] we are informed that there is a further relation between the renal organs and the generative system which is of interest. We are taught that in the mollusks the genital organs are shut off from the renal system, and open to the exterior by a special duct directly continuous with the organ. This is very unlike the animals with a body-cavity, for in them the genital organs very generally are related to the body-cavity

[1] *Mitt. Zool. Stat. Neapel*, Vol. IV, p. 420.
[2] *Quart. Jour. Mic. Sci.*, July, 1883,
[3] *Zeitschr. f. w. Zool.*, XXIX, p. 583.

and to the renal organs. Von Ihring's studies show that in some mollusks there is a direct relation between the renal organs and the genital organs. In the lamellibranchs he found that the kidneys are paired pouches opening to the exterior by paired orifices, that the genital organs are likewise paired pouches, that there are three modes by which these open to the exterior:

1. By a distinct orifice distinct from the renal orifice of the same side. This is the common mode, and was observed by Von Ihring in Tridacna, Isocardia, Seripes, Cardium, Gastrochæna, Mya, Cosbicula, Donax, Psammobia, Venus.

2. By a distinct orifice situated upon the same papilla with the renal orifice of the same side, *e. g.*, Mytilus.

3. By an orifice directly into the renal pouch of the same side, *e. g.*, Modiola, Modiolaria, Mytilus, Yoldia, Avicula, Isognomon, Margaritifera, Pecten, Spondylus.

There is here then ground for supposing that the genital system as well as the renal system may have stood in relation with the pericardial cavity in the early molluscan forms.

Hubrecht[1] describing Proneomenia states that the duct from the reproductive organ runs straight through the pericardium, and is in communication with it, and that in Chætoderma there is also a communication between the generative and pericardial cavities, and that this is the remnant of a primitive condition, and is similar in its meaning to the condition of things in Patella and Fissurella where renal and genital system open on some papilla, while in most gastropods even this slight indication of a previous closer relation is lost.

The morphology of these organs has been recently further illuminated by Grobben,[2] who has just published a paper upon the renal and genital systems and body-cavity of mollusks. This paper contains many interesting and suggestive thoughts, but the important results as far as they concern my present purpose may be summarized as follows:

1. In *Sepia officinalis* there is a pair of kidney sacks, with epithelium strongly glandular where these occupy the region of the body where the hearts and main vascular trunks are situated, and these kidney sacks open to the exterior by proper papillæ. A ciliated opening leads into this kidney sack from a cavity lined with ciliated epithelium; this cavity contains the gill hearts, the aortic heart and the genital organs. The ovary is a ridge in this cavity formed of folds of peritoneal epithelium, and ova are developed from its cells. Eggs from it are caught up by the open end of an oviduct and conveyed through it to the mantle cavity.

2. In *Eledone moschata* the peritoneal space is not large as in Sepia, and does not surround the hearts, it is small and little

[1] *Proneomenia sluiteri*, *Quart. Journ. Micros. Sci.*
[2] Claus' Arbeiten, Vol. v, p. 179.

more than a reproductive organ, its walls being almost completely occupied by the folds which give rise to the ova. But it is most important to observe that a narrow tubular channel runs from it into the kidney sack opening, then by a ciliated mouth and lined with ciliated epithelium.

Grobben in his article states the obvious conclusions that this reproductive organ of the cephalopod is the remnant of a body-cavity, and that in the vast majority of existing Mollusca we have, as the sole surviving portion of the primitive body-cavity of the Mollusca, the pericardium, the renal organs and the genital glands.

Grobben promises a future paper with the details fully described and figured, upon the subject of this communication. It promises to be a most important contribution.

In the light of these facts it would seem that the separation of the Mollusca from the animals with true body-cavity, as is done by the Hertwigs, is not justified, for though their body cavity is at present insignificant, it would seem that this is due to the loss of the same and an early condition of greater likeness to the enterocœls rather than to an essential unlikeness reaching back to the earliest ancestor.—*Henry Leslie Osborn.*

Note on the Pelvis in Birds and Dinosaurs.—By the papers of Hulke[1] and Marsh[2] a new light was given upon the morphology of the pelvis in birds and dinosaurs. That part in birds previously considered as pubis was now the postacetabular part of this bone, the real pubis was seen on the "pectine" process" (Huxley). This preacetabular part of the pubis is called "pubis," the postacetabular portion "postpubis." This view seems generally adopted to-day.

I have recently had occasion to examine the pelvis of young chickens, quails and ducks, and I find that the "pectineal process" does not belong to the pubis; this process forms a part of the ilium. Bunge[3] has the same opinion, and lately this point has been discussed by Dollo.[4]

Notwithstanding that Dollo found correctly that the "pectineal process" belongs to the ilium, he homologizes it with the pubis, believing that this process was formerly distinct. "En effet, cellecié dans un organe rudimentaire, pourraît être ossifiée *par usurpation* directement avec l'ilium" (p. 95).

Farther he considers the pubis and postpubis of the dinosaurs forming originally two distinct elements. "Il résulte de tent ce que nous verrons de dire que le *pubis* et le *post-pubis* seraient

[1] *Hulke, T. W.* Appendix to "Note on a modified form of Dinos. ilium hitherto reputed scapula." Quart. Journ. Geol. Soc., Vol. xxxii, pp. 364–366, Aug., 1876.

[2] *Marsh, O. C.* Princ. charac. of Am. Jur. Dinos. Pars. i, xii, *Am. Journ. Sci. and Arts*, Nov., 1878, Jan., 1879. *Marsh, O. C.* Odontornithes. 1880.

[3] *Bunge, Al.* Untersuchungen zur Entwicklungsgeschichte des Beckengürtels der Amphibien, Reptilien und Vögel. Dorpat, 1880.

[4] *Dollo, M. L.* Troisième note sur les Dinosauriens de Bernissart. Bull. du Mus. roy. de Belgique, Tome ii, 1883.

primitivement des éléments séparés et que, *seuls*, les Dinosauriens et les Oiseaux persideraient ce dernier" (p. 97). I can only agree on the last point with Dollo.

Sabatier[1] has figured the pelvis of a young *Casuarius galeatus*. In this specimen the line which separates the ilium and the pubis crosses the "pectineal process;" the upper half belongs to the ilium, the lower one to the pubis. This I think affords a solution to the problem.

The upper part of the "pectineal process" forming a part of the ilium, corresponds to the whole "pectineal process" of the Carinatæ and to that part of the dinosaurian ilium which articulates with the pubis; the lower part is homologous with the pubis of the dinosaurs, which has become quite rudimentary in the Carinatæ.

With this interpretation the researches of Miss Johnson[2] agree, though only partially, for she considers the pectineal process of the chicken as the pubis. She found in embryos of the chicken a well-developed preacetabular part of the pubis, which she homologizes with the pubis of dinosaurs. This is quite true for the lower and anterior part, but we can only detect in the upper part elements of the pectineal process, *i. e.*, elements of the ilium. A sharp line between the ilium and pubis at this time of development cannot be drawn, for both the ilium and the pubis consist of a single cartilaginous mass.

It is interesting to trace the development of the postpubis in the series of dinosaurians and birds. The oldest dinosaurs, as also the carnivorous forms, have no postpubis. In the Sauropoda it begins to appear (Camarasaurus, Mososaurus, Atlantosaurus), and in the Stegosauria it is well developed. In the Ornithograda it shows still a greater development; at the same time the pubis gets shorter; in the Ratitæ there is only a small part of the pubis to be seen; in the Carinatæ (whether in *all* is still a question) it is quite rudimentary, whilst the postpubis has become greatly developed.

	Carn. Dinos.	*Saurop.*	*Stegos.*	*Ornithop.*	*Rat.*	*Carin.*
Pubis	well developed.	well devel.	well devel.	well develop. Reduction beginning (Iguanodon).	very small lower part of pect. proc.	quite rudimentary.
Postpubis . .	wanting.	begins to appear.	well devel.	well devel.	well devel.	very much developed.
Ischium . .	larger than postpubis.	larger than postpubis.	a little larger than postpubis.	larger than or equal to postpubis.	equal to or smaller than postpubis.	smaller than postpubis.

[1] *Sabatier, N.* Comp. des Ceint. et des Membres antèr. et postér. dans la série des Vertébrés. Montpellier, 1880. Mém. de l'Acad. des Sciences et Lettres (Sect. des Sciences, tom. IX, 1880, Pl. VI, Fig. 1.

[2] *Johnson A.* On the development of the pelvic girdle and skeleton of the hind limb on the chick. Quart. Jour. Micr. Soc., Vol. XXIII, new series, Pl. XXVI and XXVII, 1883.

From this table it will be seen that the carnivorous Dinosaurs stand in *no direct* genetic connection with the birds. There is no "postbubis" in the carnivorous Dinosaurs; these forms seem to become extinct in the Cretaceous, leaving no descendants.

In the herbivorous Dinosaurs and especially in the ornithopod-like forms we must seek for the ancestry of birds, and evidently that of the Ratitæ, the Carinatæ being thus considered as descending from the Ratitæ. It is not at all evident that Archæopteryx belongs in the carinate line as Dames believes.—*Dr. J. G. Baur, Yale College Mus., New Haven, Conn., October, 1884.*

THOMASOMYS, A NEW SUBGENERIC TYPE OF HESPEROMYS.—We have been greatly interested in the progress of Mr. Oldfield Thomas's studies of South American Muridæ—a difficult group on which we think this author has succeeded in throwing much needed light. His latest paper, a valuable one upon Jelski's Peruvian collection (P. Z. S. June 17, 1884), divides the unwieldy genus Hesperomys into the following groups: Rhipidomys, Oryzomys, Calomys, Vesperimus, Onychomys, Scapteromys, Phyllotis, Habrothrix and Oxymycterus. Mr. Thomas's arrangement shows "that the name Calomys is restricted to the small group to which it was originally applied by Waterhouse; that Oryzomys, which was hitherto supposed to include only two North and Central American species, really contains the great mass of the South American vesper-mice to which Calomys has been commonly applied; and that the range of Dr. Coues's subgenus Vesperimus extends down as far south as Peru, since it contains the two species *H. cinereus* and *H. taczanowskii*, formerly placed by me with much doubt in Rhipidomys, but which I now think must either be referred to Vesperimus or be made the type of a new subgenus" (l. c., p. 450).

Having lately, through Mr. Thomas's courteous attentions, been able to inspect these two species in the British Museum, we incline to the latter alternative, and accordingly propose the above subgeneric name, based upon the following characters: Form stout. Pelage copious. Tail about as long as head and body, hairy, but annuli distinctly visible. Soles perfectly naked. Ears hairy inside. Front upper and front lower molar each with six cusps, three on a side, opposite one another. Mammæ six. Habits monticoline. Type, *Hesperomys cinereus* Thos. Dedicated to Oldfield Thomas, Esq., assistant dept. of mammals, Br. Mus.—*Elliott Coues, Washington, D. C.*

AN EGG-LAYING MAMMAL.—Without doubt the most valuable zoölogical discovery of the past year was the announcement made to the British Association, at Montreal, in a telegram from Australia, that Mr. W. H. Caldwell, who went there for the purpose of studying the development of some of the curious animals found there, had discovered that the Monotremata are oviparous, and

that the egg is meroblastic. No statement, says *Science*, was given in the telegram as to whether the observations related to the duck-bill (Ornithorhynchus), or to the spiny ant-eater (Echidna); but the main points of interest are the discovery of the oviparous habits of a mammal and the meroblastic development of its egg, as occurs in reptiles, since the eggs of mammals are, as embryologists would say, regularly protoblastic. This shows, says the reporter, that we must turn to the reptiles for the ancestors of the mammals.

THE AMERICAN BADGER IN OHIO.—Last summer there appeared in our local papers several sensational articles about a so-called "ghoul," which was robbing the graves and devouring the dead in some village or villages in Wood county.

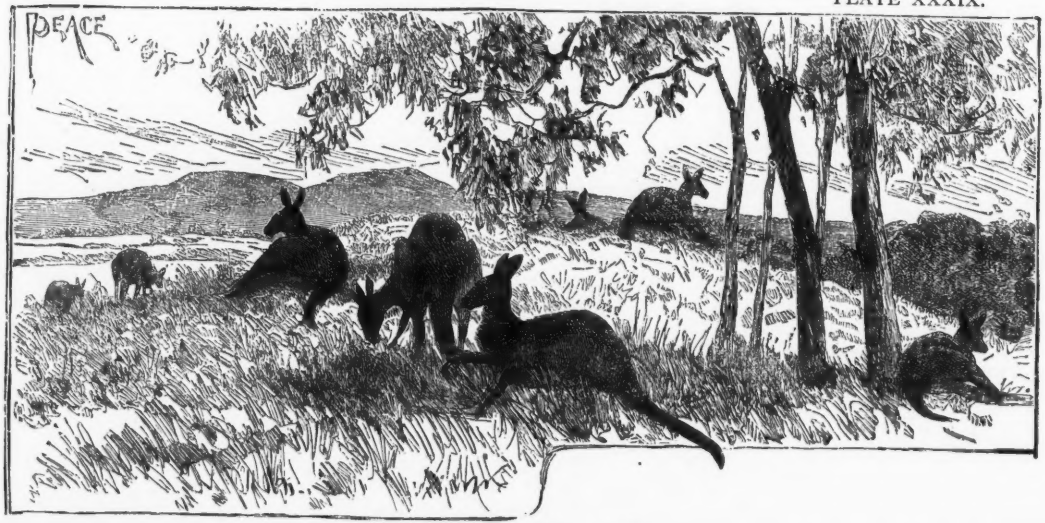
I did not, of course, pay much attention to these wonderful stories; but some time after noticing them I saw outside a beer saloon on one of our principal streets a placard to the effect that the "Wood county ghoul or grave-robber," was to be seen within. The man inside informed me that many people had been to see the strange creature, but no one knew exactly what it was, but the best informed pronounced it a nondescript animal hitherto unknown. A single glance sufficed to show that it was a fine and unusually large specimen of the American badger, *Taxidea americana*.

The poor beast had been caught in a large steel bear-trap, and had lost one of his fore feet. He seemed quite docile and contented except when the keeper stirred him up with a stout club, when he snarled viciously, and displayed enormous strength.

I thought that perhaps the capture of a badger in Ohio, where it has long been believed to be extinct, might be a matter of some interest. His burrowing among the soft earth of the new-made graves, is in accordance with its well-known subterranean habits; and the story of its devouring the dead is in strict accordance with the mental characteristics of a rural population, though of course destitute of any foundation in fact. The rarity of the animal hereabouts is evident enough from the failure of the numerous persons, hunters and others, who saw it to identify it. —*J. H. Pooley, M.D., Toledo, Ohio, Oct. 22, 1884.*

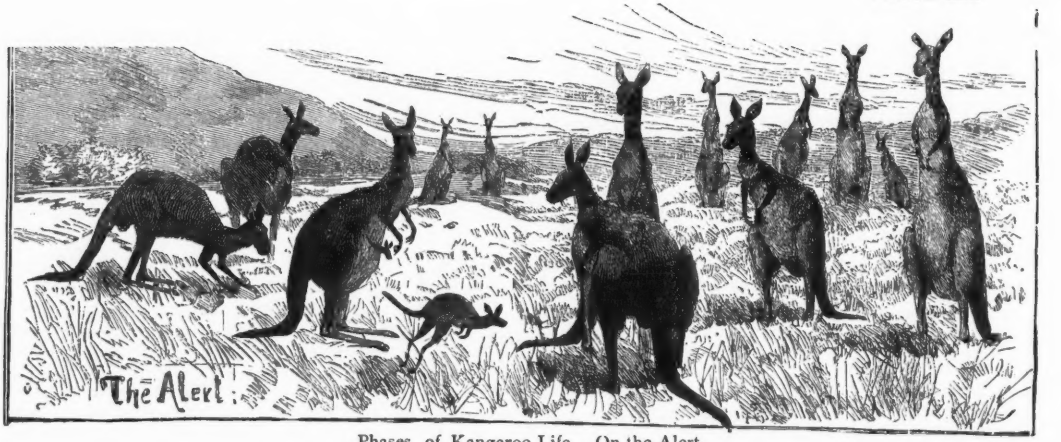
PHASES OF KANGAROO LIFE. — The accompanying series of sketches, says the *Illustrated Sydney News*, serve to illustrate three particular phases of marsupial life, so to term them. In its wild state there is perhaps no animal more timid than the kangaroo, and in proportion to its natural timidity it possesses the acute sense of hearing. When grazing in mobs they are constantly on the alert against surprise from their greatest natural enemies, the dingo and the Australian black, whose cunning in stalking them is marvelous. What means they possess of communicating approaching danger to one another is of course a mystery, but

PLATE XXXIX.

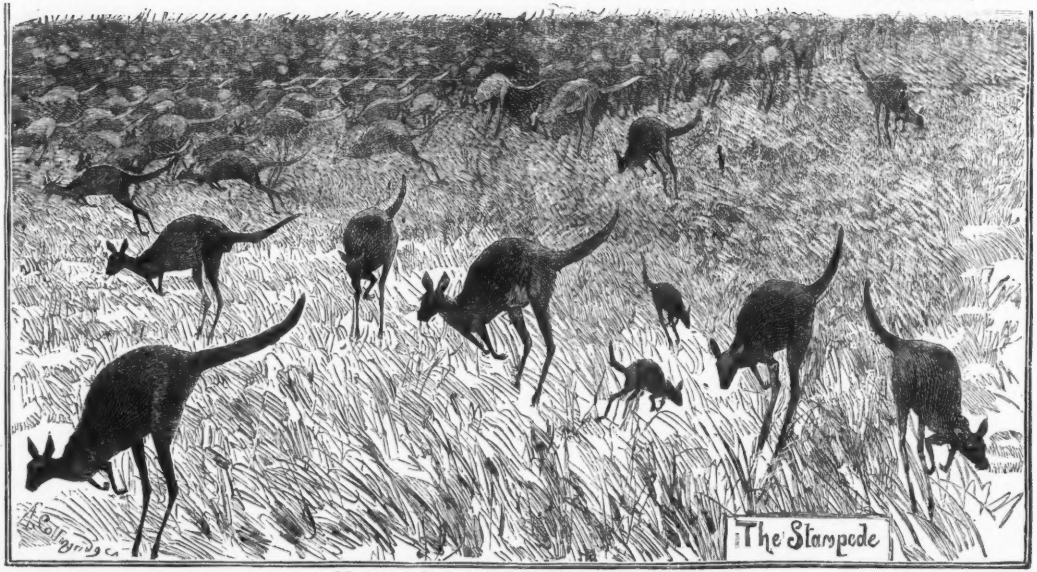


Phases of Kangaroo Life. At Peace.

PLATE XL.



Phases of Kangaroo Life. On the Alert.



Phases of Kangaroo Life. The Stampede.

apparently the alarm usually is given by the warning animal striking the ground violently with its hind foot. The mob at once rear themselves up and sniff for the source whence danger is supposed to be approaching. The "joeys," as the young ones are called, cling to the backs of their mothers, and if very young secrete themselves in the pouches, and, led by some "old man" warrior, a stampede takes place. We are indebted to the *Scientific American* for the use of these illustrations.

HABITS OF THE GORILLA.— The gorilla recently shipped to Philadelphia and now in the possession of Professor Cope, was shot in the Ogowé delta, on the left bank of the main channel of the Ogowé river, near a place called "Orângâ" (the deep), about fifty miles in a direct line from the Atlantic ocean. Gorillas are not found on the right hand of the Ogowé, at least not near the river, but from the left bank all the way to the coast.

The great Ogowé delta, following the windings of the river, is 165 miles in length and perhaps ninety miles wide at the widest part. The upper part contains many red clay hills, one at least being 600 feet in height. Excepting these, the land is low, most of it being just below the flood line. The lowest land is covered either with coarse grass — the food of hippopotami and manati—or papavers. The higher lands and hills are covered with a dense forest or jungle of palm and other trees. The gorilla seems to be attracted to this region by two particular kinds of wild fruit of which he is very fond. He is always found in the wildest, darkest and most secluded parts of the forest, and greatly dislikes the presence of man. When aroused he is brave, and fights with great fury. He is so feared but very few men have the nerve to hunt him, especially as it is necessary to let him come within a few (twelve is the rule) feet before firing, owing to the darkness of the jungle. The man who shot this one was looked upon with wonder and admiration by all the people, every one of whom believed he was possessed of a powerful fetich or he could not have killed him. The entrails were given to some Pangwe (cannibals, the Fans of Du Chaillu and the Niam Niam of Schweinfurth) who esteemed them a great delicacy, and the universal opinion here is, that I sent him to America for the white man to eat. They were greatly disgusted with my wasting so much good rum on him when they would liked to have poured it down their throat so well. The gorilla is a rare animal even in that part of the country where he makes his home, and opportunities to obtain specimens occur but seldom. Old males, as this one, live alone, while as many as two families are seldom, at least, seen together. Many wonderful stories of them are told by the natives, but as one never knows how much to believe of native stories I will not repeat them here. In my opinion Du Chaillu is the best living authority on gorillas. I would believe his state-

ments even if they conflicted with my own observations, because he understands them better than I do . It may be interesting to note that the people here look upon them as entirely distinct from themselves, yet they call them men, "wild men" and "furrent men."

The gorilla cannot make a fire, does not build a house or shelter, and does not fight with weapons except such as nature gives him in his own body. He will seize the gun or spear of his adversary and break but will not attempt to use it in his own defence. It is about practically impossible to keep the gorilla for any length of time in captivity. He becomes dejected and morose, and either starves himself or else dies apparently of a broken heart. Traders and others occasionally get young ones—I had one myself—but they do not seem happy as do chimpanzees and other apes, and they all die in the course of a few weeks. I do not suppose an opportunity to obtain another body will occur again, if it should I will send it to you. With kindest regards I remain as ever—*Joseph H. Reading, Kângwe Mission Station, Ogowé river, West Africa.*

Zoological Notes.—*General.*—The British Museum has recently published as a separate volume a report on the zoölogical collections made in the Indo-Pacific during the voyage of H. M. S. *Alert*, 1881–'82. More than three-fourths of the volume is occupied by an account of the species found in Northeastern Australia and Torres straits. Examination of the specimens of Branchiostoma affords Dr. Günther an opportunity to revise that genus, of which he admits six species. The report describes many new Mollusca, four new asteroids, four new ophiuroids and six new holothurians. Most of the twenty-seven or twenty-eight kinds of crinoids are new, and so are forty-five of the 203 Crustacea described. Twelve species of fixed alcyonarians and forty-two out of 110 kinds of sponges are described as new. Though eighty-six of the sponge species are siliceous, none of them belong to the Hexactinellidæ. Among the new forms from the Western Indian ocean are *Turtur coppingeri* (named after Dr. Coppinger, the naturalist of the expedition). A considerable number of rare or undescribed forms of Crustacea were procured at the Amirante, Providence and Glorioso islands, and twenty one new sponges are described.

Mollusca.—As a result of a series of investigations carried on at Banyuls and at the Ecole Normale, M. Houssay comes to the conclusion that there is no homology between the operculum of the Gastropoda and the byssus of the Acephala, and none between the operculum of the former and the second valve of the latter group. The operculum is an epithelial production of a corneous or calcareous structure, while the byssus is the product of a gland situated in the anterior part of the foot. This foot-gland of the Acephala is represented in a large number of gas-

tropods by a gland in the same position, but a longitudinal furrow is added in the Acephala. Every operculum is formed of the same layers, the one produced at the posterior part of the columellar muscle, while the other is laid down upon this, thickening it upon the inferior side. Sometimes a third layer is present.

Crustacea.—The thesis which has gained for M. F. Mocquard the title of "doctor" of sciences, describes the stomach of the Podophthalmia, its motor muscles and nerves. The gastric skeleton presents a special type in each family. The brachyura have a narrow and triangular mesocardiac piece, and lengthened horizontal pterocardiac pieces, while in the macrura the mesocardiac calcification occupies the entire breadth of the upper cardiac wall, while the pterocardiac pieces are generally short and almost vertical. The gastric skeleton of the anomoura proves that some are macrura and other brachyura. While with rare exceptions the gastric skeleton of the brachyura follows the tolerably uniform type, that of the macrura presents wide variations. The schizopods and stomapods present the same calcifications as the decapods, but the lateral teeth, which are rudimentary in the Squillidæ, are well developed in the schizopods. The latter have also as their special character the absence of pyloric ampullæ, while the squillæ are peculiar in the pyramidal form of the cardiac division of the stomach. The same calcifications persist through the entire range of the Podophthalmia, that is, although they may change in form, coalesce, or occasionally disappear, no additional pieces are ever found. Guided by the characters of these parts, M. Mocquard divides the Grapsoidea into two groups, one consisting of the Ocypodidæ, the other including Gelasimus, etc., and the Pinnotheres. From his study of the muscles our author has discovered that when in use the median tooth of the stomach works into the angle made by the approach of the anterior extremities of the lateral pieces, while the uro-cardiac calcification serves to retain the aliments in the required position.

Fishes.—Mr. Gilbert has been studying the fishes of White river, Indiana, and of Kansas, and finds a few new species. Among these former is the long unrecognized *Hybopsis tuditanus* Cope, which has been placed in a new genus by Professor S. A. Forbes, on account of the separation of the small dorsal spine from the rays by a membrane as in Pimephales. It is called Hypargyrus. He also states that Hyborhynchus cannot longer be distinguished from Pimephales.——Professor D. S. Jordan has been studying the fishes of the Gulf of Mexico and of the West Indies, and has written a number of important monographs of various Percomorph genera.——Professor Gill has been adding to our knowledge of the osteology of fishes, particularly of the Anacanthini and of the Plectognathi. All the above articles appear in the proceedings of the U. S. National Museum.

PHYSIOLOGY.[1]

DOES SUGAR OCCUR IN HEALTHY URINE?—The occurrence of sugar in the urine is a characteristic sign of a well known disease, but many observers have detected in normal healthy urine a sugar like glucose in quantities varying from more than .05 per cent to less than .01 per cent. Professor Wonn Müller has attacked again the question in the following form: Does sugar normally occur in urine? Has the nature of the food influence in determining its presence? Does the excreted sugar differ chemically from that ingested? Observations were made upon two healthy students whose urine proved to be sugar free. Quantities of starch taken just before meal time had no effect upon the composition of the urine.

Levalose taken in the same way was also followed by negative results. Milk-sugar, cane-sugar and glucose, when eaten in quantities of 50 to 250 grammes, could be detected in the urine. It is worthy of observation that the sugar thus excreted was unchanged chemically and had therefore been unaffected by the ferments of the alimentary canal or by the liver cells. During this excretion the amount of fluid passed was, strange to say, rather diminished. The greater part of the sugar found was excreted in 3 to 5 hours after ingestion. Scarcely 1 per cent of the sugar eaten could be recovered in the urine.—*Pflüger's Archiv. Bd. 34, s. 576.*

WHY ALBUMEN DOES NOT OCCUR IN NORMAL URINE.—The laws regulating diffusion in the living body are among the most important and darkest problems of physiology. Albumen passes, under the forces of diffusion and filtration, through the walls of the blood-vessels into the lymph spaces; why does not albumen find its way in the same manner into the glomeruli of the kidney and form a normal constituent of urine? Graham showed, long ago, that various inorganic salts were capable of different rates of diffusion and that the individual diffusibility of each might be altered when more than one salt were mixed together; in general the diffusion of the less soluble salt was retarded. Regéczy, starting from these facts, has come to some interesting conclusions concerning the conditions regulating the diffusion of albumen. He finds that albumen in the presence of a neutral salt diffuses into distilled water less rapidly than when in watery solution, and this difference is more marked the more salt the mixture contains. Albumen diffuses more readily into salt solution than into distilled water. Diffusion of albumen proceeds more rapidly from dilute than concentrated solutions. Pressure upon the side of the albumen aids its diffusion. The explanation for these facts seems to lie in the high osmotic equivalent of the inorganic salts toward which strong diffusion currents of water are attracted, and

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Mich.

these currents accelerate or retard the diffusion of albumen as they chance to move in the same or the opposite direction to the latter. Salt and water are filtered and diffused from the blood into the glomeruli of the kidney. The water rapidly rediffuses back into the denser blood, leaving salt behind and in more concentrated solution in the kidney tubules. These return currents of water prevent the passage of albumen into the tubule, but not of the readily diffusible salts which still continue to leave the blood. The urinary secretion becomes thus progressively denser, and if by any cause the salt contents of the urine so nearly approaches that of the blood that the water currents from tubule to blood-vessel cease, then the passage of albumen begins, and albuminuria is the result.—*Pflüger's Archiv, Bd. 34, s. 431.*

Localization of Function in the Brain.—Goltz has long been the principal and worthy opponent of those who hold that the various psychical powers are distinctly and permanently localized in separate parts of the cerebral cortex. But the professor of physiology at Strassburg now concludes from the results of a new series of experiments that, though there can be no such minute distribution of function as Ferrier and others would claim, still there are manifest differences between the physiological properties of different cerebral areas. Goltz submitted a number of dogs to operation, removing in some cases the cortical anterior and in others the posterior portions of both hemispheres. The animals were kept under observation for some months after complete recovery. The behavior of the dogs differed according as the anterior or posterior part of the brain was affected. 1. The dog from which the anterior part of the cortex had been removed retained all the bodily sensations; he may possess a fine tactile sense but still he uses that sense ill. He treads the air with the feet when walking. No muscles are paralyzed, all are under voluntary control, still the movements are clumsy and rather helpless. The attempts at feeding are particularly unskillful; he does not understand how to hold a bone with the fore feet. He does not hesitate to leap down from an elevation. Reflex irritability is increased. Very frequently the animal's character becomes changed so that he is more impatient and more easily angered than before the operation. He wanders restlessly about. Sense perceptions are not weakened in a very marked manner, but general intelligence is always somewhat lowered. 2. The dog which has lost the posterior portion of the cerebral cortex retains undisturbed his tactile sensations and appears to use them well. He does not beat the air with the feet when walking. His muscles are not only not paralyzed but he uses them nearly as skillfully as a normal dog. He hesitates to jump down from an elevation. Reflex irritability is not heightened. If the animal were savage before the operation he becomes quite docile after it; he cannot be stirred up to any emotion. He suffers a general weakness of

perception and his general intelligence is very low. A dog which has suffered the loss of the anterior cortex has usually a tendency to emaciation, while one whose brain has been operated on posteriorly is always fat; the former animal is also liable to a severe skin disease accompanied by itching.—*Pflüger's Archiv, Bd. 34, s. 450.*

PSYCHOLOGY.

THE PSYCHICAL RELATION OF MAN TO ANIMALS.[1]—Professor LeConte's article opens as follows: "In the *Review* for November, 1878, I published an article on 'Man's place in nature.' The present article may be regarded as a continuation of the subject from a different point of view. In the former article I tried to show how, without violating the laws and analogies of nature, the spirit of man may be conceived to have arisen by progessive individuation out of the forces of nature, through the vital principle of plants and the anima of animals. In this I wish to fix attention on the last and most important step, and to determine, if possible, its nature. I wish to show in what consist the essential differences between the spirit of man and the anima of animals."

Professor LeConte admits the probable evolution of the human mind out of the animal mind, but believes that at some point of history, one perhaps coincident with the origin of the human species, a new type of mental power originated, which constitutes the spirit of man. He illustrates this proposition by reference to the history of development of human individuals at the present day. He traces the appearance of this especial power in the growth of the mind of the child, in language, in useful art, in fine art, in thought proper, in self-consciousness, and in free will. The power in question is simply the power of generalization. It commences in thought, in which it is the perception of law; it appears in speech in the power of expression of such perception of law; in useful art in the conscious working for a purpose; in fine art in the perception and execution of harmonies. These propositions are clearly presented and ably argued. They express a great truth, one which is probably true of all normal human beings. It is, however, not so certain that the power of generalization is limited to man. It is probably not so limited, but exists in a small degree in the mental operations in the highest animals. Hence we cannot perceive that Professor Le Conte proves in this way the existenee of a "human spirit," distinct from "the anima of animals." Professor Le Conte does not, it appears to us, grant sufficient mentality to animals, especially in his discussion of imagination (p. 252). His belief, however, that the memory of animals is not, in their minds, distinguished from present events, is probably partly true, though we can scarcely believe that the highest animals do not retain an idea of the true successional relation of events.

[1] By Professor Jos. LeConte, rom the *Princeton Review* (no date on the separata).

Self-consciousness is regarded by Le Conte as peculiar to man. This may be, but we have not yet looked into the recesses of the minds of the lowest races of man, nor do we know the conditions of the minds of the chimpanzee and orangutan in this respect.

The author believes in free-will as that form of mental activity "in which consequences, especially moral consequences, are presented to the mind and weighed; when impulses, solicitations, motives, are weighed one against another; when all these mental conditions become themselves in their turn the objects of conscious thought, and we feel distinctly conscious that we ourselves determine, and are therefore responsible for, the final result," etc. This form of stating the case will naturally be regarded by the determinists as a *petitio principii*. If the author of it had wished to strengthen his position as fully as it is susceptible of support, he should not have omitted the argument to be derived from the condition of ignorance coïncident with high intelligence, where the experience which is the condition of automatism is wanting, and when, therefore, if progress is made, acts must be free if they are ever so. Though this hypothesis[1] is not a demonstration, it is as near to it as we shall ever get, and preferable to mere assertions of our belief in our freedom. In one paragraph, under the head of free-will, Professor Le Conte allows his theology to get ahead of his philosophy (p. 259). He says "there is a free-will, which is free only in the sense of self-determined, and therefore morally responsible, but is nevertheless unwillingly restrained by and chafes against the impassable bounds set about it by the all-embracing will of God, which is the perfect law of Righteouness —and there is a freer will, freer because no longer restrained by law; because the law of righteousness is freely accepted as the law of its activity; because it moves in loving accord with the absolute will." Now to say nothing of the assumption contained in this paragraph as to the origin and nature of the law of righteousness, the assumption of superior freedom of will on the part of him who obeys this law, is illogical. That man in whom the law of righteousness is habitually obeyed is, so far as this fact is in evidence, as much of an automaton as he who obeys only the laws of his animal instincts. The period of creation, which is a period of labor, is preëminently the period of freedom, and good habits are clearly just as automatic as bad ones. *It is however not necessary to believe that a freedom of will once gained need ever be lost.*

Finally, this supposed freedom of will cannot be attributed to animals. But it is far from certain that it is possessed by all men, that its assumption as a distinctively human characteristic is not exact. It may be rather a *possibility* for men, and as such more

[1] On the origin of the Will, by E. D. Cope. *Penn Monthly*, 1877, p. 435.

likely to prove the "spirit" or "soul" of man, so much talked of, and so little explained, than any other mental quality.—*E. D. C.*

MORE CONCERNING CATS' FOOD.—It was said by some eminent man that no one could know any one subject perfectly without knowing a little of everything. I base my claim to this universal knowledge on cats.

On our old place in the country we maintained a small standing army of cats, to keep down the rats, which had overrun the house and farm-buildings, and had defied fire-arms, poison and traps. These cats were not pets; they lived very greatly in the woods and fields and were just enough domesticated to give a fair chance of observing their ways. It was soon perceived that there was almost as much diversity of taste among them, in regard to food, as there is among human beings. They all ate meat and milk, and there, I think, the community of taste ended.

There were many generations before my own recollection serves me very clearly. The first one that stands out very clearly in my memory is "Old Trilobite" so-called, somewhat viciously, not from her extreme antiquity, but on account of a peculiar *trill* in her voice. Old Trilobite was a small, slender Maltese. She lived little in the house, save in the coldest part of the winter; she was a mighty hunter, and the mother of a numerous and hardy progeny of almost every possible variety.

She would not touch butter, nor anything made with it, although it was the best of fresh butter, nor would she eat anything sweet. She was partial to sour milk. She was often absent for days on hunting excursions in the woods; on her return she refused every kind of butcher's meat, but it was accidentally discovered that she would eat *raw salt pork* on such occasions; she also demanded bread, and would eat a quantity of it. I do not remember any other cat that ate salt pork, or indeed any salt meat or fish (unless it had been very much "freshed," which amounts to the same thing), and old Trilobite seemed only to eat it as a corrective to an exclusive game diet.

"Jack," one of Trilobite's kittens, resembled her in many respects as to habits, but did not accord with her dietary. She ate cake. She was also very partial to cheese, which Trilobite would not touch. Cats differ greatly as to their liking for cheese. Some are extravagantly fond of it; others will not touch it.

Cats, in general, like green vegetables. Asparagus is a favorite. Corn, beans and peas many cats will eat raw. Corn, Dr. Dimmock mentions, is often eaten by cats who do not care for other vegetables. Potatoes, generally, are refused. As an odd taste, I remember that of one who would eat the *peels* of boiled potatoes, but not the potatoes themselves; in this case it was the mere skin stripped carefully off, with little or no potato adhering to it

Pet cats, Dr. Dimmock has remarked, will usually eat anything

the petter eats, or at least try to do so. I have seen them eat candy, dates and figs. One, only a semi-pet, who usually rejected sweets, was found one day picking out and eating the raisins from a piece of cold pudding.

Some cats will positively eat nothing but meat. I had one such. He was a yellow and black brindle, and I understood that this was a hereditary trait. But he once made an unexpected raid on some cream-cakes, and once condescended to eat Brighton biscuit. My present cat, "Pug," has much of the same tastes. He will now and then, out of politeness, take a bit of something else, but will not really eat anything but meat. He does not, however, like it raw, except when very hungry, a few bits of raw beef, other meats not at all. I have known of cats who would eat *only* raw meat, but never had such a one.

Almost all cats will eat eggs—cooked or raw. "Pug" would, in his younger days, but he is apt to refuse them now. "Nanny Longclaws" (originally "Ninon de l'Enclos") was so fond of eggs that breaking the shells would bring her rushing into the house even from such a distance that one would have thought she could not hear the sound.

They are, I think, to a cat, fond of fish—many extravagantly so. Oysters are in the same standing as cheese among them. Some will cry bitterly for them as soon as they perceive they are on hand; others reject them positively.

"Blanche," one of the two cats now attached to the establishment, will, I believe, eat *everything* except fruit and salt pork. She was born omnivorous, not having been especially petted in her kittenhood, nor brought up on a miscellaneous diet.

One Maltese cat, attracted probably by the musky odor, would not only drink the water in which India ink had been mixed by washing the brushes, but lick the saucer on which the ink had been rubbed. They are partial to perfumes.

A great many of them, as Dr. Dimmock observes, will catch and eat insects. "Blanche" has a great liking for dor-bugs. Moths are favorites too. "Squash-bugs," I judge, are not, remembering the highly disgusted expression and attitude one assumed after an attempt to deal with one of those highly-flavored creatures. Devil's darning needles I have seen caught and devoured. Grasshoppers, I think, are usually acceptable. I, too, had a cat who used to catch and bring them to me. Another one caught frogs and brought them to me, and, I fancied, was rather disappointed that I did not eat them. They will kill snakes, and sometimes partially eat them.

Much that is interesting can be said about the long-neglected and greatly-calumniated cat. I think its psychology deserves attention. I have observed in them a capacity for friendship among themselves.—*Francis M. Slack, Librarian Mus. Comp. Zoology.*

ANTHROPOLOGY.[1]

ASSOCIATION NOTES.—The meetings of the British and the American Association in coöperation brought together many anthropologists of distinction, and the papers read were of uncommon interest.

At the British Association the important feature was the address of vice-president Tylor on some American aspects of anthropology. A few of the topics discussed in the paper were:

The effect of a quarter of a century's research the giving to Quaternary man a more and more real position.

Did man likewise inhabit America at the same period?

Are the present Eskimo the remnant of such an early race?

(Upon this last point Mr. Tylor suggested a yachting cruise down the coast of Labrador to fix the locality of Vine-land.)

The recent advances of zoölogy and geology have given new breadth and facility to the discussion of the relation of the North American aborigines to Asiatic peoples.

The only safe method of philologic research is the combination of dictionary and grammar. Attempts to trace analogies of words in Asiatic and American languages have proved no correspondence beyond what chance coincidence would produce.

The comparison of peoples according to their social framework has not assumed a great importance.

The tendency to treat everything prehistoric as necessarily o great antiquity is growing weaker.

The northward drift of ancient American civilization is evidenced by the distribution of maize, tobacco and cocoa, and the spread of agriculture.

Mr. Horatio Hale read a treatise on "The origin and nature of wampum." It was a notable fact, he said, that while the partly civilized Indians of Central and South America carried on commerce without money, among those of the United States and Canada a monetary currency was in common use. Their wampum was formed in the shape of small disks or cylinders, of shells perforated through the center and strung together on strings of deer's sinew. The system had been found so convenient for purposes of exchange that it had even been adopted by some of the early colonists. In most cases the material was the conch periwinkle and *Venus mercenaria.* The colors were white and purple, or black—which was twice as valuable as the white, on account of its rarity. These shell arrangements differed from the cowries of the East Indies. In course of time they came to have a social and political significance. Important acts of state policy were confirmed by the gift or exchange of them. On the occasion of treaties belts of wampum were presented. Each belt had its own device woven in white on a dark

[1] Edited by Professor OTIS T. MASON, National Museum, Washington, D. C.

ground, or *vice versa.* The rude pictorial emblems generally employed resembled the early Chinese characters. Wampum was also devoted to sacrificial and funeral ceremonies. It has been found in abundance in the mounds of the Mississippi valley; and, in our own times, was in vogue west of the Rocky mountains. In traffic, the value was rated sometimes by the length of the strings, sometimes by the number of beads. There was a larger kind, consisting of oblong strips, with holes for stringing. Going far to the westward there was found among the Micronesian islanders an almost similar usage. They made their wampum of the disks of shells, of cocoa-nuts or of the tortoise-shell. In the Loo-Choo islands the inhabitants had what was known as "cash," small circular copper coins. The Chinese themselves anciently used tortoise-shells. Of the earliest Chinese copper money, some pieces were round, others oblong. The Celestials had also mock-money, made of tin foil and paper for sacrificial uses, which might be taken as evidence that their money at first consisted of combustible material. The inference to be drawn from the existence of such media of commercial exchange among those oriental peoples was, that at some period the idea of shell money had been carried from East Asia or Micronesia to the shores of America. The fact that Japanese junks had been known to be wrecked on the Pacific coast was to the point in the argument. The Micronesians, moreover, were accustomed to make protracted voyages in their well-rigged vessels, and it was not impossible that some of their craft might have drifted to our shores where the occupants would come in contact with the Indians. Whether, however, the use of wampum was derived from the East or not, it could not be denied that it gave evidence of good intellectual powers. It was to be regretted that a subject of such interest had been so long treated with indifference in America. At present there was great scarcity of wampum belts, though some that had been preserved were of deep interest and of considerable historical value. One which was shown to the audience was said to be 160 years old. It was of rare beauty of make and significant design. Four dark squares (the rest being of white beads) were interpreted to mean four Indian towns. Another which Mr. Hale exhibited was even more remarkable in its structure, displaying emblematic figures. The use of wampum for mnemonic purposes was also explained, and Mr. Hale showed photographs of the chiefs (Six Nations) to whom he was indebted for his interpretation. Interesting to Canadians were some beads found in Orillia county by Mr. Hirschfelder, who believed they had been the property of the Hurons.

The paper gave rise to a most animated discussion, in which Mr. Cushing (who had spent so many years among the Zuñi Indians), Mrs. Erminnie Smith, Mr. Putnam, Major Powell and Dr. Tylor took part. All the speakers expressed the deep satisfac-

tion with which they had listened to the paper, and their gratitude to Mr. Hale for the light that he had shed on a subject so important.

The address of Professor E. S. Morse, as vice-president of Section H of the American Association, was upon Man in the Tertiaries, the full text of which was given in the October NATURALIST.

The following papers were read at the meeting:

Uses of the emblematic mounds. Stephen D. Peet.

The lineal measures of the semi-civilized nations. D. G. Brinton.

Description of the skeletons and skulls found in the large mound of the Turner group. Miss C. A. Studley.

The sacred pipes of friendship. Frank LaFleche.

Some observations upon the usage, symbolism and influence of the sacred pipes of fellowship among the Omahas. Alice C. Fletcher.

Notes upon some quartz objects from Central Minnesota. Miss F. E. Babbitt.

The importance of the study of primitive architecture to an understanding of the pre-historic age in America. Stephen D. Peet.

Local weather lore. Amos W. Butler.

Some characteristics of the Indian earth and shell mounds on the Atlantic coast of Florida. Andrew E. Douglass.

The manner in which Indians made their stone implements. P. R. Hoy.

Disputed points concerning Iroquois pronouns. Erminnie A. Smith.

The use of the plough in Japan. Edward S. Morse.

The sacrificial stone of San Juan Teotihuacan. A. W. Butler.

Mythology of the Wintuns. J. W. Powell.

Archæological explorations by the Peabody Museum of American Archæology and Ethnology, communicated at the request of the trustees of the museum. F. W. Putnam.

Interviews with a Korean. Edward S. Morse.

Some parallelism in the evolution of races in the old and new world. Daniel Wilson.

On the geographical distribution of labretifery. W. H. Dall.

Remarks on North American races and civilization. E. B. Tylor.

Upon the evolution of a race of deaf-mutes in America. A. Graham Bell.

The occurrence of man in the Upper Miocene of Nebraska. Edward D. Cope.

The three culture periods. J. W. Powell.

A search in British North America for the lost colonies of Northmen and Portuguese. D. G Haliburton.

Eastern archery. Edward S. Morse.

Formation of Iroquois words. Erminnie A. Smith.

The different races who built mounds in Wisconsin. Stephen D. Peet.

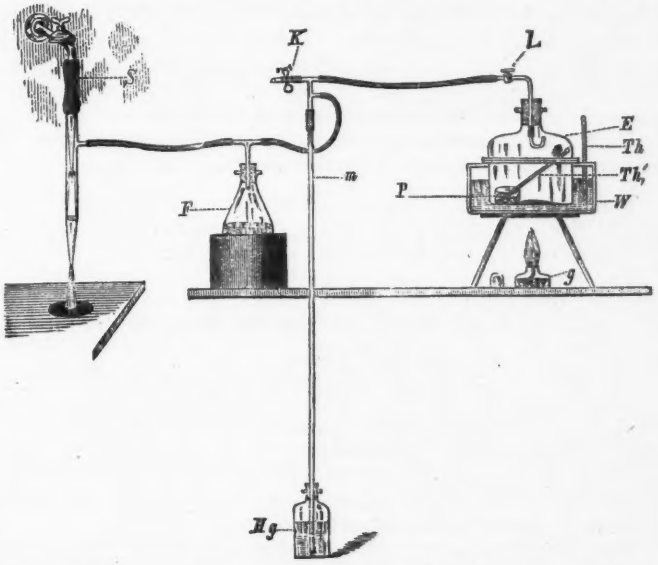
Evolution of animal life illustrated by study of emblematic mounds. Stephen D. Peet.

Etymology of the Iroquois word Rha-wen-ni-yu. Erminnie A. Smith.

A CORRECTION.—In noticing the brochure on the Okadaira shell mound, at Hitachi, the editor of these notes, in praising the Japanese explorers, inadvertently did injustice to Professor Morse. It is well known to all of the readers of the NATURALIST that the entire credit of the exploration in the Omori shell-mound, and of the publication of the results, is due to Professor Morse, and no one would be more willing to acknowledge that fact than the present writer.

MICROSCOPY AND HISTOLOGY.[1]

IMBEDDING APPARATUS.—The complete saturation of objects more than a few millimeters in thickness with paraffine is often a difficult operation. After soaking for hours in melted paraffine, it is frequently found, when it is too late for remedy, that saturation has not been sufficiently complete in all parts of the object. In imbedding relatively large anatomical preparations, the penetration of the paraffine to all parts can be secured by the aid of a good air-pump; but this method is tedious, and robs one of time. The same end may be reached with very little cost of time and labor by means of a suction-pump, such as is used in chemical laboratories, provided only that the water pressure at command is sufficiently great to do the work. Dr. F. W. Hoffman[2] has described a very simple apparatus to be used with the suction-pump.



The suction-pump, *S*, is connected with the exsiccator, *E*, by means of rubber tubing, through each portion of which runs a piece of glass tubing as a protection against undue compression. The exsiccator, holding the small basin of paraffine, *P*, in which is placed the thermometer, *Th'*, stands in a zinc pan, *W*, containing water and a thermometer, *Th*. The capacity of the pan should be such that the temperature of the water can be kept quite even during the process of imbedding. The flask, *F*, introduced between

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoology, Cambridge, Mass.

Zool. Anz., VII, No. 165, p. 230, 1884.

S and *E* by means of a T-shaped tube, serves to catch any water which may find its way into the connecting-tube in consequence of variation in the water-pressure. The glass tube, *m*, the lower end of which is in a bottle of mercury, serves as a manometer. The pressure indicated enables one to judge whether the preparation is saturated with paraffine.

In using this apparatus the water-bath, *W*, should be first heated to a temperature of about 60°; then the basin, *P*, containing *melted* paraffine and the object to be imbedded, may be placed in the exsiccator and the pump set in operation. When the mercury reaches the highest point in the tube, *m*, and air-bubbles cease to rise from the object, the process is ended, and the air admitted by loosening the screw-clamp, *K*. Before admitting the air, the stop-cock, *L*, can be closed, in case it is thought best to leave the preparation still longer in vacuum. As soon as sufficient time has been given for complete saturation, the stop-cock, *L*, is opened slowly, and the air streams in. The end of the connecting-tube is bent upward in *E*, in order that the paraffine may not be disturbed by the inflowing air. Finally, the object is taken out and placed in a box of melted paraffine and left to cool.

With a water-pressure of 700—720 mm. Hg., most objects will be completely saturated within 20 minutes.

Treatment of the Ova and Embryos of the Aphides.—Witlaczil[1] gives a lengthy paper on the development of the aphides, and in it the following information on methods:

The embryos of the viviparous aphides were examined in a weak salt solution (1 ½ per cent), in which they live for about an hour. The ovaries contain embryos in different stages of development, and have to be isolated for study.

The early stages in the development of the ova may be studied to advantage after treatment with hydrochloric acid (3 per cent), or acetic acid, as these reagents partially dissolve the yolk elements and thus render the preparation more transparent. The later stages, on the contrary, are rendered more opaque by the same treatment.

The ovaries of viviparous aphides were prepared for sectioning, by Ludwig Will,[2] in the following manner:

The aphis is killed in water heated to about 70° C., then hardened in successively higher grades of alcohol. In order to color in toto, the cuticula must be punctured with a sharp needle, and then the dye will penetrate easily to all parts. As very thin sections are required for the study of such small elements, it is best to use dyes that stain very deeply, such as borax-carmine and hæmatoxylin. It is further necessary to employ either the shellac or the collodion method of fixing the sections, otherwise the important parts are liable to drop out of place.

[1] *Zeitschr. f. wiss. Zool.*, XL, Heft 4, p. 563–564.

[2] Semper's Arbeiten, VI, 1883.

THE ORGANIZATION OF THE ECHINORHYNCHI.[1] — 1. *Method of Preparation.*—It is a very difficult matter to kill Echinorhynchi instantly. This cannot be done either with corrosive sublimate or strong osmic acid, even after preliminary treatment with tobacco smoke or chloroform. Thus treated, they contract strongly, and remain so after death.

Much the best results are obtained by killing gradually with 0.1 per cent osmic acid, in which they contract during the first hours, but stretch out again and die fully extended. This method causes slight swelling, but does not seriously injure the object for histological investigation. In specimens left for twenty-four hours in the osmic acid, it is easy to isolate under the dissecting microscope the subcuticula, and the two layers of muscle-fibers (circular and longitudinal). For the study of the internal organs, the Echinorhynchi should be cut open immediately after death and transferred to a 0.01 per cent solution of osmic acid. The preservation of specimens thus treated may be accomplished in the following manner: After carefully washing away the osmic acid, place the objects in a very dilute solution of potassic acetate in an open vessel, and leave them for two or three days, during which much of the solution evaporates. Finally transfer to a saturated solution in order to clarify so far as possible. Very beautiful preparations are said to be thus obtained.

The course of the nerves may be easily traced in specimens that have lain several days in 1 per cent formic acid. The tissues swell up strongly and become quite transparent so that the nerves can be seen. If the muscular layers be separated from the subcuticula in specimens thus treated, and then stained in gold chloride, the lateral nerve-trunks may be clearly shown. For the histological study of the nerves, the Echinorhynchi should be treated with chromic acid and then stained deeply with borax-carmine.

Chromic acid preparations are also best for the study of the subcuticula. Echinorhynchi live for days in a one-tenth per cent solution of chromic acid, but eventually die in a fully extended condition. Such preparations, after treatment with alcohol, may be colored at once; or, after washing a day or more in running water, exposed to the action of osmic acid, and then colored in borax-carmine.

For the study of the sexual organs, a very dilute picro-sulphuric acid (one part of the acid to eight-tenths part of water) is recommended.

The tissues of the Echinorhynchi are not easily stained. Borax-carmine, which, according to Sæfftigen, is the best staining fluid, must be allowed to act a long time (often one or more days); after a deep stain has been taken, the preparation should be partially discolored by the use of hydrochloric acid in the ordinary way.

[1] *A. Sæfftigen, Morph. Jahrb.*, X, Heft 1, pp. 120–163, 1884.

2. *Histology.*—The outer body-wall of the Echinorhynchi consists of four layers: a very thin *cuticula*, a thick *subcuticula*, an *outer muscular layer* (circular fibers), and an *inner muscular layer* (longitudinal fibers).

The subcuticula, which constitutes by far the larger portion of the body-wall, is a complicated web of muscular fibers, in which may be distinguished an inner and an outer zone. The inner zone, lying next to the layer of circular muscle-fibrils, is made up of radial fibers united into bundles. These bundles have the shape of sheaves, the fibers spreading at the ends, but drawn closer together at the middle, so as to leave a system of spaces or canals. Two longitudinal canals are thus formed, having in some species a lateral position, in others a dorsoventral position; and these main trunks are connected by a net-work of anastomosing canals. This system of vessels is filled with a clear fluid, in which numerous granules, resembling oil spherules, together with large nuclei, are suspended. The wall of these vascular spaces consists of radial muscle-fibers alone, showing no indication of a lining epithelium. Sæfftigen thinks that the canal-system of the anterior end, including the lemnisci, does not communicate with that of the rest of the body.

The outer zone of the subcuticula is made up of alternating strata of longitudinal and circular fibers, and is not penetrated by the canal-system. The radial fibers of the inner zone penetrate this outer zone, and reach to the cuticula. Between this outer zone and the cuticula is found a layer which Baltzer has called the "*Streifencuticula*," and which has hitherto been regarded as an inner cuticula. Sæfftigen has brought forward pretty conclusive evidence that this layer is not cuticular, but muscular; and he holds that it is merely a bounding zone of the subcuticula, in which the muscular fibers are more closely packed than in the so-called "outer zone" of the subcuticula. The subcuticula presents essentially the same features in the proboscis and neck as in the body proper.

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SCIENTIFIC NEWS.

— The meeting of the British Association at Montreal was an extremely interesting one and very largely attended; while the interest was mainly centered upon topics pertaining to physics, the proceedings of the sections of geology and of biology were notable. The section of geology was presided over by Dr. Blanford; fifty-one papers were presented. Aug. 29th was given to essays and debates on glacial phenomena, in the course of which Professor James Geikie expressed his inability to draw any sharp line between moraines and kames, as they merge into each other so that one cannot say where one leaves off and the other begins. Kames he regarded as partly morainic and partly of subglacial origin. Debates on the archæan rocks, and the eozoön, were

opened by Professor Bonney. The most fresh and interesting palæontological essay was that of Mr. G. F. Matthews on the primitive Conocoryphean.

The section of biology was presided over by Professor Moseley, of Oxford, whose opening address was on the physiology of deep-sea life. A paper by Mr. C. Spence Bate, of Plymouth, England, on the geographical distribution of the macrurous Crustacea, led to a discussion in which Professor Moseley remarked that deep-sea Crustacea either had very large eyes or were eyeless, and that there must be a source of light in the deep sea, that source, he claimed, was phosphorescence, but its light must be very dim.

An abstract of Dr. Sollas' paper on the origin of fresh-water faunas has already appeared in this journal. Papers by G. E. Dobson on the geographical distribution of the bats, and by H. Saunders on that of the gulls and terns (Laridæ) was followed by an essay by Professor Gray on the distribution of plants, wherein he called attention to the resemblances and differences between the flora of North America and that of Europe.

A telegram was received from Mr. W. H. Caldwell announcing his discovery that the Monotremata (whether the Ornithorhynchus or Echidna was not stated) are oviparous, while its development is meroblastic as in reptiles. This is certainly the most remarkable zoölogical discovery of the year.

Professor A. Milnes Marshall read a paper on the mutual relations of the recent groups of Echinoderms, with especial reference to their nervous systems; his results we shall present hereafter. Other communications we shall notice in a later number.

— The Chesapeake Zoölogical Laboratory of the Johns Hopkins University was opened for research, at Beaufort, North Carolina, from June 1st to September 19th, and its facilities were used by ten naturalists. Owing to the illness of the director, Professor W. K. Brooks, he was able to spend only one month at the laboratory, and it was, for two months, in charge of H. W. Conn, Ph. D., professor of zoölogy at the Wesleyan University, Middletown, Conn. The experiment, of a year since, in Chesapeake bay, has demonstrated that Beaufort is the best available locality for work. The building at Beaufort furnishes accommodations for only six persons, and as the party of ten crowded it so much as to hamper the work the director was compelled to refuse several applicants.

— M. Bertrand, the Secretary of the French Academy of Science, recently made the important announcement that England had joined the International Commission, which meets once a year at Paris, to consider the metric system. Thus England sets itself in accord with the ideas of all Europe, and in the near future will make the French system obligatory. This decision, taken by England at the last moment, that is to say at the opening of the

International Congress at Washington which is to determine a common prime meridian, is not, perhaps, an absolutely disinterested one. England desires the ratification of the decision of the Scientific Congress held last year at Rome, which adopted the meridian of Greenwich.—*Exch.*

— A useful pamphlet is Mr. John A. Ryder's tract "On the preservation of embryonic materials and small organisms, together with hints upon imbedding and mounting sections serially. Extracted from the annual report of the Commissioner of Fish and Fisheries for 1882." The principal object of this essay, says the author, is to afford directions to collectors desiring to preserve the embryos of the lower vertebrates, fishes and amphibians in such a condition as will enable the investigator to use them in his researches. "As ordinarily preserved in alcohol such objects are next to worthless, either for figuring or dissection, as well as totally useless for microscopic preparations."

— The U. S. Geological Survey is engaged in a bibliography of North American geology. The work when completed will give the title of each paper with the title-page of the containing book, and the number of plates, the whole being arranged alphabetically by authors. It is also intended to prepare at the same time a number of more restricted bibliographies, each covering a division of geological literature. The plan includes abbreviated titles of papers with references to the pages on which the special subjects are treated, the entries in each bibliography being arranged alphabetically by authors.

— The editor of *Papilio* announces "that unless a more self-sacrificing and less impecunious and business-like editor can be found, *Papilio* will probably cease to exist at the end of this year." We hope that relief will be sent to the editor and publisher, Mr. Eugene M. Aaron, lock box 916, Philadelphia, Pa., and would add *apropos* of entomological journals in this country, that if the three now published could be consolidated into one, it would be better in all respects. We still need a well sustained entomological journal, such as ornithologists possess in the *Auk*.

— At the meeting of the Entomological Club of the American Association Adv. Science, at Philadelphia, Dr. Horn called attention to the historical associations connected with the place in which the club then met. "On that very spot, in the old Museum of Natural History, Thomas Say, poor in pocket, though rich in brain, put up his bed under the skeleton of some large mammal, and this for months was his only home. There also he contracted the illness which resulted in his death."

— The Museum of Comparative Zoölogy has published the third in its series of bibliographies to accompany "Selections from embryological monographs, compiled by Alexander Agassiz, Walter Faxon and E. L. Mark." This part is a bibliography of Acalephs, by J. Walter Fewkes, and bears date of July, 1884.

This series, with its admirable illustrations, are most useful adjuncts both for the beginner in zoölogy as well as the working embryologist.

— During the quarter ending September 1st, 13,796 persons have visited the museum of the Peabody Academy of Science, the largest number on any one day being 456 July 1st, the day Barnum's circus was in Salem. The most important accession to the museum has been a collection of lemur skins from Madagascar.

— C. H. Gilbert has been appointed Professor of Biology in the University of Cincinnati in the place of Professor W. G. Wetherby resigned. Joseph Swain takes the place of Professor Gilbert as assistant professor in the University of Indiana.

— George Bentham, the distinguished English botanist, died Sept. 10 at the age of 84. His Hand-book of the British Flora was widely used in Great Britain, while Hooker and Bentham's Genera Plantarum, finished a year ago, made his name familiar to botanists the world over. His work in systematic botany has extended over half a century, beginning in 1825.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ACADEMY OF NATURAL SCIENCES PHILADELPHIA, March 27, 1884.—Professor Lewis reported the discovery of itacolumite at two localities in Pennsylvania, one in Lancaster county, the other near Spring Mills, on the Schuylkill. He believed the itacolumite to be identical with the Potsdam sandstone. Mr. Hotchkiss gave details respecting the coal mine at Pocahontas, where 114 miners were recently killed by an explosion, and suggested that the dry coal dust in the air of the mine, by mingling with the gases of the gradually rising galleries, may have been the cause of the catastrophe.

April 3.—Dr. Leidy called attention to the existence of a reef of *Serpula dianthus* at Barnegat bay. Mr. Ford reported the finding of several specimens of *Mellita testudinaria* on Anglesea beach, N. J.

April 10.—Dr. D. G. Brinton was inaugurated as professor of ethnology and archæology, and delivered a lecture on prehistoric man in America. After giving due weight to all objections, the lecturer argued that there was evidence in favor of the presence of man upon this continent long anterior to any historic date of the old world. The origin, development and history of the native American race must, therefore, be studied separately, without any attempt to identify it with any race of the eastern hemisphere. The common origin must be placed very far back.

April 17.—Dr. C. Dolley suggested with regard to the so-called parenchymatous digestion of Salpa and Auchenia, an interpretation totally different from the one usually received. The

endostyle of the branchial sac, in Salpa, throws out a supply of mucus which covers the surface, and in which nutritive particles, finding their way into the animal, are imbedded. The food is carried back by cilia, and the mucous sheet is wound up into a thread which can be traced into the œsophagus, and thence into the stomach. This mucous exudation Dr. Dolley believes to be identical with the amœboid cell which has been described as taking up the nutritive particles and passing them on to the tissues. Dr. N. A. Randolph described a test for the detection of small quantities of peptones in solution.

April 24.—Dr. Leidy called attention to a discovery of fossil remains of mammals in Florida, indicating the existence of a formation of later Miocene or Pliocene age differing from those before known. Though mostly in fragments, the fossils exhibit no appearance of being water worn or abraded by friction. Among the remains were those of a mastodon, also of a rhinoceros rather shorter than the existing species, bones of a llama, a tapir and of a large ruminating animal exceeding in bulk the Irish elk. Professor Heilprin stated that rock fragments received from Mr. Willcox contained six or seven genera, and specimens of microscopic Paludina were associated with them. These might indicate the presence of fresh-water swamps in ancient Florida, or the emptying of a river into the sea.

NATIONAL ACADEMY OF SCIENCES, Newport, R. I., Oct. 14, 15, and 16, 1884.—The following papers were read:

On the columella auris of the Pelycosauria. By E. D. Cope.
The brain of Asellus and the eyeless form of Cecidótæa. By A. S. Packard.
On the theory of atomic volumes. By Wolcott Gibbs.
On the complex inorganic acids. By Wolcott Gibbs.
Notice of Muybridge's Experiments on the motions of animals by instantaneous photography. By Fairman Rogers.
Notice of Grant's difference engine. By Fairman Rogers.
On the Thinolite of Lake Lahontan. By E. S. Dana.
On the Mesozoic coals of the Northwest. By R. Pumpelly.
On the work of the northern transcontinental survey. By R. Pumpelly.
The grasses mechanically injurious to live stock. By Wm. H. Brewer.
On gravitation survey. By C. S. Peirce.
On minimum differences of sensibility. By C. S. Peirce and J. Jastrow.
Researches on Ptolemy's Star-Catalogue. By C. H. F. Peters.
On the operations of the United States geological survey. By J. W. Powell.
The motion of Hyperion. By Asaph Hall.
Remarks on the civilization of the native peoples of America (by request). By E. B. Tylor.
Some results of the exploration of the deep sea beneath the Gulf Stream, by the U. S. Fish Commission steamer *Albatross* during the past summer. By A. E. Verrill.
Recent progress in explosives. By H. L. Abbot.
On an experimental composite photograph of the Members of the Academy. By R. Pumpelly.
Report on meridian work at Karlsruhe. By W. Valentiner.
On the algebra of logic. By C. S. Peirce.
On the temperature of the lunar surface. By Samuel P. Langley.
On methods of eastern archery. By Edward S. Morse.

APPALACHIAN MOUNTAIN CLUB.—Oct. 8, 1884.—A paper by Professor George Davidson entitled "Account of the Volcano

Makushin, on the Island of Unalaska, in the Aleutian Chain," was presented by Professor E. C. Pickering. Dr. J. F. Frisbie read a paper entitled "A tramp over Ossipee mountain."

Professor Samuel H. Scudder presented a communication on "The movement of Hôtel des Neuchatelois on the Glacier of the Aar."

NEWTON NATURAL HISTORY SOCIETY.—At the annual meeting in October the following officers were elected: president, Dr. J. F. Frisbie; vice-president, George L. Chandler; treasurer, S. E. Warren; secretary, A. C. Brackett; curator and custodian, Jesse Fewkes. A resolution was passed in commemoration of the late John L. Ordway, who was an active member of the society. The annual address was delivered by the president, J. F. Frisbie, his subject being "A tramp through Tuckerman ravine up to the summit of Mt. Washington."

NEW YORK ACADEMY OF SCIENCES.—Oct. 13th.—The following paper was read: Notes on a recent visit to Northern Montana, —its scenery, resources, and geological structure (with lantern illustrations), by Dr. John S. Newberry.

Oct. 20.—The following papers were read: Notes on the constitution of oceanic, river, and desert sands, by Dr. A. A. Julien; On certain peculiarities of the mussel (Mytilus), by Mr. B. B. Chamberlin.

Oct. 27.—Notes upon the recently-discovered columnar trap exposures on the east face of Orange mountain, N. J., were presented by Professor D. S. Martin, Professor H. L. Fairchild, and Dr. N. L. Britton, with photographs and sketches taken by Professor Fairchild and Mr. B. B. Chamberlin.

BOSTON SOCIETY OF NATURAL HISTORY.—Oct. 1, 1884.—Mr. S. Garman spoke on sharks and their classification.

Oct. 15.—Professor Hyatt spoke of the discovery of supposed winter buds in a marine sponge.

PROCEEDINGS OF THE AMERICAN PHILOSOPHICAL SOCIETY.—April 18.—Extracts from a report on the Ham's Fork coals of Wyoming Territory, by P. W. Sheafer, were read; Mr. Lesley exhibited models of the Nittany valley and Bald Eagle mountain, and of the Jones mine, made by Mr. E. B. Harden. Dr. Hunt stated that the iron ore of the Jones and other mines with analogous ores were referable to the horizon of H. D. Rogers' primal slates, though they lie in immediate contact with the Trias. Dr. Frazer said that some of the mines (as at Dillsburg, York Co.) penetrate the Trias, yet the Triassic iron ore deposits may be but the redeposited detritus of more extensive primal slate ores.

May 2.—Mr. Phillips made a communication on a supposed Runic inscription, found upon a rock weighing about 400 pounds, on an island at the mouth of the Tasket river, on the shore of the Bay of Fundy.

May 16.—Prof. Cope described the rich collections of vertebrate fossils in the museums of the City of Mexico. Some species are yet undescribed.

June 20.—Professor Cope read a paper upon the extinct Mammalia of the Valley of Mexico.

July 18.—Dr. Gill's notes on the Stromateidæ were presented for publication, and Professor Cope presented a paper by W. G. Stevenson on a man-eating shark caught off Nantucket.

August 15.—Professor Cope presented a paper upon "The structure of the feet in the extinct Artiodactyla of North America," also a "Fifth contribution to the knowledge of the fauna of the Permian formation of Texas."

ILLINOIS STATE NATURAL HISTORY SOCIETY.—The field and annual meeting was held at Peoria, July 7th. It was intended to combine for this occasion the features of the field and annual meetings, heretofore held separately, the programme of papers and discussions being varied with short excursions for collection and field observation in the vicinity.

The following papers were read: Illinois forests and forestry, by T. J. Burrill; New developments in the Streater coal field, by Edwin Evans; Mastodon and other remains of the loess and drift clays, and their relation to the climatology and geology of the deposits, by William McAdams; Explorations of Indian mounds in Dakota, by William McAdams; Ancient pictographic records on the rocks in the vicinity of the Missouri river, by William McAdams; Experiments with a living copper-head serpent, by William McAdams; Notes on marine algæ, by A. B. Seymour; Recent investigations in relation to the rise of sap in trees, with experiment, by A. B. Seymour; Some corn fungi, by A. B. Seymour; Notes and observations on silk culture, by J. E. Armstrong; On two forms of phytoptus galls on the leaves of *Nyssa multiflora*, by H. Garman; On the artificial production and propagation of insect diseases, by S. A. Forbes; On the fishes of Illinois, by S. A. Forbes. An election of officers was held at which the Hon. William McAdams, of Alton, was made president for the ensuing year, and S. A. Fowler, secretary; Professor Burrill and Mr. J. E. Armstrong were made vice-presidents; Tyler McWhorter was elected treasurer and Dr. Edwin Evans and Mr. A. H. Munelt were chosen as additional members of the Executive Committee.

At an evening session a finely illustrated description of the development of the teeth in man and other vertebrates was given by Dr. Will X. Suddath, of Bloomington, highly interesting to those present, and the president-elect of the society, Mr. McAdams, gave an address on the fossil remains of the bluff clays of the Mississippi river, passing around numerous fossil specimens of the teeth and bones of land animals lately found by him imbedded in nodules in this formation.—*S. A. Forbes, Secretary.*

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